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Electricity for All.

THE greatest thing about electricity is the universality of its touch! In this do we find our surest ground for hope for the future of the enormous industries that have developed around the scientific theory and the practical application that have already meant so much to the entire human race since Faraday laboured in such humility.

Electricity touches life at every point from the cradle onward all our days, from the peasant's cottage to the prince's castle, in mean domestic duty and in mighty whirl of industry, in the city and on the sea, at dizzy heights and in mining depths, all round the globe, in all the lands, in all the zones, in sickness and in sport, in the village shop and the sky-scraping store—anywhere, everywhere!

Does it not send the blood coursing more freely as one lets the imagination play with the thought of its promise for the future? Its limitations are few to-day, and they promise to be fewer still as the scientist, and the industrial executor of his discoveries, pass on their way piercing supposed impenetrable obstacles and achieving new triumphs, bringing more and more facilities within the scope of our common life.

Is it not excusable once in a way for us to banish for a few moments the thousand details that nearness to the industry bring before us editorially with clamorous persistency every day and every night, and to try to rend the veil and conjure up the wonder that lies beyond? Changes of ideas, supersessions and obsolescences in men, in policies, in plant, and in industry, price wars and other forms of competition, all these and manifold prosaic developments of which they are but illustrations, there long have been and will be longer still; those who follow will meet these changes and face new problems, but

electricity will make continuous and triumphal progress oblivious of them all.

Such is the large view that should make for hope and confidence amongst all who follow the electrical calling, be it in profession or in trade. The future of electricity is sure—but we are brought down to earth by the peremptory reminder that upon ourselves, our forethought, our foresight, our adaptability to evolving situations, and our alertness to reap rewards, depends to some extent the value of that future to those who earn their daily bread therefrom. By the most efficient pursuit of the immediate task we shall best prepare the way for those who follow.

Inasmuch as we believe profoundly in the competency of the rising body of electrical men we go forward with confidence, and it is in no spirit of gloom regarding the electrical industry that we place before the trade another annual issue of the Electrical Review concerned with some of the outstanding Domestic and Power Developments that are proceeding in our midst.

The progress that is taking place in the electrical illumination of the home and of the public place; electric heating appliances for the home and electric welding and furnaces for industry; electric cooking and manifold other domestic appliances; all have generous allocations of space, as has also the spread of rural electrification, while articles from special contributors discuss certain aspects of technical and other subjects.

A mixed menu, not intended for consumption at a single sitting, but placing something before everybody for consumption and digestion at some time. We covet the reader's co-operation and appreciation of our effort.

Progress in Illumination.

Electric lighting is now a great deal cheaper than before the war, mainly on account of the improvement in the incandescent lamp. This improvement has brought with it a need for something more than the rather crude arrangements used for pre-war illumination. As we state at the head of the article on the subject in this issue, electricity is now definitely breaking away from the converted gas fittings and copies of gas fittings which were accepted as correct for so many years.

Electric lamps can now be obtained in many shapes, colours and sizes, and accordingly the technical limits imposed upon the design of fittings are practically negligible, and the artist and manufacturer can concentrate upon securing beauty and efficiency. The designer is taking full advantage of this freedom and some of the results are illustrated in our article. It should be said that these examples are " units " as opposed to " architectural " lighting, which is of an extensive nature and can only be illustrated by views of actual installations.

Electric Fire Design.

Passing in review the models of electric fires introduced for the 1930-31 season, we come to the conclusion that there has been little variation from accepted principles. The departures which have been made practically all relate to externals, that is, in the appearance of the fires, and consequently the already bewildering number of designs available has been added to considerably. The tendency towards lighter construction which we have noted in recent years seems to have been arrested, the majority of the new models being built on substantial lines—in some cases rather too substantial we fear. Imitation coal fires continue to increase in number, indicating that the manufacturers appreciate how deeply ingrained is the love of the cheerful, but dirty and wasteful, coal grate.

We recommend the article on electric fires in this issue to our readers' attention, feeling sure that among the forty typical examples illustrated (out of the thousand and one available) they will be able to find what they want for themselves or for their customers.

Cooking and Water Heating.

The effect of the general trend in the reduction of electricity tariffs for domestic supplies has been particularly marked during the past twelve months, especially so with water heating, in connection with which a similar position to that held by electric cooking a few years back seems to have been reached. Consumers are impressed and almost ready to venture, but they cannot get a clear answer to the question " Is it expensive? " By very far the greatest advance in electric cooking has been made where suitable two-part tariffs are in vogue. Admittedly the water-heating-tariff problem is quite definitely a different one from that of cooking charges, but we far from despair of seeing the evolution of a tariff common to both domestic services.

The desirability of this, and its importance, are coming more into evidence as the close relationship between electric cooking and water heating is becoming realised. In his article on " Electric Water Heaters " Mr. E. Eaves raises an important question. He asks whether it is necessary to place any restrictions on the hours during which electricity is used for this service, and suggests that with a range of operation for the thermostat of not less than 10 deg. F. the normal use for hot water is such as to prevent a demand during the evening peak. Tests carried out under working conditions in the U.S.A. appear to support such a view, and, certainly, it is very desirable to avoid restrictions on the use of electricity if the economics of the situation make this in any way possible. In our corresponding issue of last year we commended to the consideration of our readers the idea of using small electric geysers of not more than, say, 4-kW loading in conjunction with electric cooking. We have been particularly interested since that date to see the introduction (first at the British Industries Fair in February last) of apparatus which, from the point of view of the results obtained, practically combines the principles of the electric storage heater and the geyser, rendering supplies of hot water fit for drinking almost immediately available. The provision of tinned-copper interiors in water heaters, so that the hot water is drinkable, is another indication of the close link between cooking and water heating.

With regard to development in the production of cookers, the display of the preliminary manufacturers' samples of the British Standard Cooker at the I.M.E.A. Convention at Eastbourne was perhaps the most interesting event of the year. While, we understand, certain modifications have yet to be agreed upon before the cooker can become a standard production, the fact that leading manufacturers have found it possible to agree to a common design is a very hopeful sign.

Generally the main developments in cooker production have been in the simplification of design, particularly in connection with the wiring (internal), much of which is now arranged on the bus-bar principle, and also as regards finish, which in many cases is rendered particularly attractive by modern artistic enamelling.

Electric Welding Equipment.

As with industrial electric heating (indeed, with any electrical application), so with electric welding, one of the main features of its use is the ease with which work can be controlled. While at present electric welding development does not appear to have attained to the same high position in this country, relative to competitive methods, as do other electrical industrial applications, the possibilities as regards both engineering manufacture and load building are, nevertheless, very considerable.

The work that has been, and is being, done in America in the welding together *in situ* of steel girders for the construction of buildings is very promising, and it provides an excellent subject for educational development work in this country. Repair work by electric welding has proved in many cases to be the most economical method, particularly in the case of railway and tramway tracks. Again, electric welding in the manufacture

of small articles, such as iron and steel tubes and drums, provides a very wide field for exploitation.

There are machines available for all these and many other purposes, as our review of British electric welding equipment elsewhere in this issue shows.

This review should be correlated with the article by Mr. E. W. Lewis, who gives a comprehensive survey of recent remarkable developments in welding throughout the world. Electric welding is surely destined to modify existing engineering practice to an almost unforeseeable extent, even perhaps to fulfil Henry Ford's expectation of seeing the end of the casting and the rivet.

Electric Furnaces.

Perusal of a review of the electrical furnace equipment which is now available, such as that given elsewhere on later pages, leaves one with the impression that electricity ought to be now the principal medium of industrial heating. It is for the supply industry largely to see that its rightful position is delayed as little as possible. There is electric-furnace equipment available to meet almost every requirement, involving individual loadings from only a few hundred watts up to hundreds of kW, and producing temperatures from about water boiling point to well over 1,000 deg. C.

Perhaps the most important advantage of electric furnaces is the ease with which the temperatures can be controlled. Automatic governing at very high temperatures within half-a-dozen degrees is a simple matter. In support of this we may cite the case of certain aluminium alloys mentioned by Mr. Verdon O. Cutts in his article; these require a temperature of 500 deg. C. for their treatment, and an increase of only 2 per cent. above that figure would spoil them. On the other hand, regulation between very wide limits of temperature, representing very light and full loadings, is an equally simple matter.

One of the most interesting developments of recent years has been the high-frequency furnace, the commercial application of which has been largely, if not wholly, due to the h.f. generator. A rotary machine which will give a supply at over 2,000 cycles per second is no mean engineering achievement.

In our leading columns of May 23rd last reasons were given for the view that, in order to combat the smoke nuisance, the campaign for domestic electrification should be supplemented by efforts to spread the use of electricity for industrial heating. Moreover, as Mr. Cutts states, the electric furnace provides an ideal load for the supply undertaking and unquestionable advantages to any works requiring heat that is readily available and easily controlled.

Overhead Lines.

A notable departure from current British practice relative to the distribution of electricity in sparsely-populated country districts appears to be contemplated in parts of the Electricity Commissioners' rural electrification demonstration area in Bedfordshire, following upon the Bedford borough electrical engineer's recent statement that it is possible to lay and maintain low-voltage cables underground more cheaply than it is to distribute energy by means of overhead lines, and thus to assist in preserving village amenities.

Whilst the contention cannot be gainsaid in special cases and particular localities, the incidental reference to æsthetic considerations being a significant clue perhaps, any implication of its general applicability will be refuted by the records to be found elsewhere in this issue of some small portion of the overhead-line erectional work that has been accomplished during the past twelve months in parts of Scotland, England, Wales, and Ireland.

The celerity with which the national 132,000-volt interlinking-grid transmission system is being erected has somewhat overshadowed its contemporary lower-voltage networks of secondary transmission and distribution lines that are growing remarkably all over the countryside. The descriptive notes published on later pages are illustrative of typical examples of aerial feeders and distributors, the use of which is generally conceded to be an economic necessity in most counties wherein rural tracts have to be served thriftily in anticipation of frugal initial use.

This economic necessity is emphasised in the article by Mr. J. T. H. Legge appearing in this number, which amplifies and brings up-to-date the account given in our issues of February 14th and 21st of developments in the thinly-populated areas of the Shropshire, Worcestershire and Staffordshire Electric Power Company.

An interesting example of a radical departure from accepted practice is the application of the constant-tension principle to main-line construction described in our issue of June 20th. Another recent new feature is the type of stranding adopted for the conductors used for the bulk supply to Marlborough from the Wessex Electricity Co., referred to in our issue of September 19th.

Combustion Problems.

Few men are better qualified to deal with the question of combustion problems than is Mr. R. A. Chattock, formerly city electrical engineer at Birmingham, who in this issue traces the development of steam-raising plant from the old hand-fired Lancashire and Scotch boilers to the latest pulverised-fuel equipment.

There is no doubt that when the burning of low-grade fuel is desired p.f. firing has come to stay, but for dealing with high-grade coal in connection with boilers of normal size in this country p.f. has certainly not yet won the day. The final decision, of course, depends on commercial considerations, and in this connection Mr. Chattock touches on two important points, the relative initial costs of p.f. and stoker plant, and the dust problem. He believes that with further simplification of p.f. equipment the costs of the two classes of plant will be about the same. He also shows that the dust trouble is much greater with the newer method of firing. Recent developments indicate that the dust problem can be satisfactorily overcome, and it will therefore have to be tackled; will the expense involved materially affect the capital cost of p.f., as compared with stoker plant?

The E.D.A. Directorship.

In the advertisement pages of this issue the British Electrical Development Association invites applications for the position of Director and Secretary of the Association which will be rendered vacant by the retirement of Lt.-Col. W. A. Vignoles. Applications have to be lodged by October 27th. In connection with this announcement we would remind our readers, and especially intending applicants, of the views expressed by us in our leading article of last week, entitled "Where is he?" The advertisement is appearing in the leading daily Press as well as in the trade and technical journals, so that the net is being spread widely in order to catch a good man. Applications have to be sent to the Chairman of the Executive within the next ten days (by October 27), and it should be noted that there is no fixed salary, so that the most eminent men in the industry have no occasion to consider themselves disqualified. Ten days does not strike us as being a sufficiently long period in which to get together particulars, but it gives the right man, wherever he is, if at home, time to let it be known that he is open to consider the matter, and it will leave the Committee plenty of time to consider the whole subject before Lt.-Col. Vignoles vacates office. There are very heavy demands upon our space this week, or we should have asked the Committee before advertising the appointment to weigh up the whole subject of organisation and see whether the interests of the industry would not be better served by the appointment of an over-all Director and a separate Secretary-Manager. Considered from the standpoint of the entire electrical industry the post of Chief of E.D.A. is one of supreme importance. We would exalt it so that it is higher than that of the leader of any other electrical organisation, for the holder of the office has to voice the needs and interpret the policies of all the sections. No hurried appointment should be made.

Mr. Clifford C. Paterson.

President of the Institution of Electrical Engineers for the 1930-31 Session, which opens on Thursday, October 23rd.

THE election of Mr. Clifford Copland Paterson, O.B.E., M.Inst.C.E., M.I.E.E., F.Inst.P., as President of the Institution of Electrical Engineers for the forthcoming session is particularly appropriate in view of the International Illumination Congress to be held in Great Britain in September of next year immediately before the Faraday celebrations.

Mr. Paterson's work in connection with illumination problems is, of course, known throughout the world, and recognition of his abilities in this sphere is to be found in his appointment as President of the International Commission on Illumination, a body which he had served for 15 years as honorary secretary. In addition to this office, he fills several prominent positions on allied bodies of a national character. He is chairman of the Illumination Committee of the Department of Scientific and Industrial Research, with which the National Physical Laboratory collaborates closely; he is also a member of the General Board of the N.P.L., chairman of the Street Lighting Committee and the Electric Lamp Committee of the British Engineering Standards Association, and was vice-president of the Illuminating Engineering Society in 1928-29. It may safely be assumed that in his dual capacity as head of the I.C.I. as well as of the I.E.E., he will do all that man may do to show visitors from other countries the soundness of our claim that the study of illumination problems in Great Britain is pursued on a thoroughly well-organised system.

Mr. C. C. Paterson, O.B.E.

Although his reputation is largely based upon his research activities, Mr. Paterson has many connections and contacts with engineering science in other directions. He has been vice-president of the Institute of Physics and is on the councils of many engineering and allied associations. Earlier in his career he carried out important heavy engineering work abroad for the Maschinen Fabrik Oerlikon, Switzerland, where his duties included locomotive testing and boring operations on the Jungfrau Railway.

Mr. Paterson is still a comparatively young man, being still in the early fifties. He was educated at Mill Hill School and at Finsbury Technical College. After serving a four years' mechanical workshop apprenticeship, he then—like so many engineers who have afterwards achieved eminence in their profession—passed through Faraday House, where he served his electrical apprenticeship in the testing department. Subsequent to his experience abroad, to which we have referred above, he was, in 1903, appointed to take charge of the electro-technical (particularly alternating current) and photometric work of the National Physical Laboratory. Here he was responsible to the director of the N.P.L. for the building up of this section and for the supervision of the research and test work for its early stages. His duties included the design and equipment of the electro-technical and photometric buildings, the development of special precision methods of measurement, and the evaluation of the necessary units. As examples of the special character of the work for which Mr. Paterson was responsible, we may cite the following: (1) the development of the electrostatic method of measuring power to a high degree of precision in alternating current circuits; (2) the establishment of the national unit of candle-power which formed, with the units of America and France, the basis of the international unit; (3) research into the visibility of navigation lights at sea, with a view to the avoidance of collisions and also to the setting up of standards; and (4) the publication of numerous documents covering these and similar subjects.

Shortly after the outbreak of the war he was responsible, with Dr. J. W. T. Walsh, for the inception and development of the Paterson-Walsh electrical height finder, which automatically gave records of the heights of aircraft, for use in anti-aircraft gunnery.

On the cessation of hostilities he joined the staff of the General Electric Co., Ltd., for the purpose of establishing and acting as director of research laboratories, co-operating in technical developments with the various factories and departments of that company. It is of interest to note the growth of these laboratories as symptomatic of the increasing importance attached to research during the past decade in the electrical industry as a whole. The *personnel* in 1919 numbered only about 12, but now consists of upwards of 300; at the present time the laboratories cover an area of about 100,000 sq. ft., and are still being extended.

Mr. Paterson's connection with the Institution dates from 1902; he has served as vice-president during several sessions. He has during his career received from the Institution important awards, including the Institution Premium, the Original Communication Premium, and the Kelvin Premium. He was responsible, in conjunction with Mr. H. T. Young, for the present excellent lighting of the Institution theatre.

Mr. Paterson is also fortunate—or, rather we should say, his fellow scientists are fortunate—in his possession of a faculty of literary expression. Evidence of this faculty is to be found in his many invaluable contributions to the publications of various learned societies.

Although it is never safe to predict the range of any presidential address, we have no doubt that the opening meeting of the Institution on Thursday next will provide an opportunity for the new President, as similar occasions have to his predecessors, to display his recognised broad-minded ability to relate the work in which he has obtained particular eminence to that of the profession as a whole, and in this manner to symbolise the co-ordinating function of the Institution itself. In taking over the duties of the premier professional position, Mr. Paterson is assured of the support and good wishes of all electrical engineers.

The Electric Lamp Industry.

By C. W. SULLY.
Director of the Electric Lamp Manufacturers' Association of Great Britain.

The author refers to the valuable work of the Electric Lamp Manufacturers in raising the standard of illumination through the E.L.M.A. Lighting Service Bureau during the last six years. During that period the lighting and domestic demand for electricity has increased 200 per cent. The sale of electric lamps has rapidly increased and the most fascinating way to develop the general domestic load is to develop the use of illumination. Mr. Sully suggests that low down "point sources" of light in rooms should, with cheap electricity, give way to "high up" sources representing bands of light. The people should have specialised advice and service from supply authorities possessing Illumination Departments. Distribution would thus become more profitable and the load factor would be improved.

OUR industry, during its early years, was fed and nurtured by illumination, that artificial attribute to human life which has done so much to develop the requirements of civilisation.

It was the amazing convenience with which illumination could be obtained electrically that put the idea into the originators of our industry to develop public utility companies and caused our municipalities to jealously espouse the industry some 40 or 50 years ago.

In spite of this very pronounced purpose which first developed the inventions of Faraday and Swan on commercial lines, those in charge of our numerous supply authorities quickly forgot the original purpose of their charters and gave little or no attention to the development of illumination. Indeed they looked elsewhere for the growth of their business, and illumination was burdened with the heaviest charges, had no attractions for their inventive genius, and was only encouraged where other loads were also available.

Illumination has only become attractive as a profession during recent years and even to-day the majority of those in charge of our electricity undertakings do not study its science, nor do they cater for the development of its utility amongst their customers.

The electric lamp manufacturers were the first to draw the attention of the public to the importance of illumination by means of their Lighting Service Bureau and their aim, during the last six years, has been to raise the standard of illumination advocated by those sections of the industry which are interested in meeting the public's demand for electric light.

They have always realised that the supply authority engineers were best able to advise the public and have persistently sought to encourage those engineers to enlighten their customers in that important direction.

Reginald Haines] [*London.*
Mr. C. W. Sully.

The Electricity Commissioners' reports show that, during the six years they cover, the use of electricity for lighting and domestic purposes has increased 200 per cent., or nearly twice as rapidly as the demand for power purposes. The fact that the sale of electric lamps has increased as rapidly during that same period shows that the improvement is not simply due to domestic appliances. Those same reports show that the average load factor, throughout the United Kingdom, has definitely improved during those same six years, and figures are available indicating that various lighting loads to-day produce load factors of 30 per cent. and even as much as 50 per cent.

The success of the grid system mainly depends upon increased load and our supply engineers are expected in future to concentrate on the development of that load; there is no better or more fascinating way of reaching that end than by developing the use of illumination.

Street lighting, shop lighting, school lighting, domestic lighting; all can provide good loads, and each requires special study in connection with the application of the light to the objects illuminated. The general practice has been to apply the light as other lights were previously applied and no effort has been made to take the fullest advantage of the peculiar adaptability of electric illumination.

For instance, "point sources" of light are used everywhere for domestic lighting, usually with the source of light placed at a minimum height above the objects requiring illumination; in fact, the only adaptability, obtainable from the use of electricity, has been the addition of portable standards which decrease the general illumination and discourage good load factors.

The only excuse for such a practice has been the cost of electricity, which to-day, under the two-part tariff system, no longer exists. With the cost of all additional current at ½d. to 1d. per unit there is no reason why the light sources should not be placed high up and represent bands of light which can then illuminate the room in a similar manner to that obtained from its windows during daylight. More of the available light will then be used and better load factors produced, even from domestic lighting.

The general public needs advice and conviction before it will think of changing its lighting methods. The easiest way to effect the remedy is for their "General Practitioner," the supply authority, to make a point of advising users of the opportunities they have missed and, when necessary, to refer them to a "Consultant" to complete the remedy.

For such purposes it will pay supply authorities to add to their organisation an illumination department which would give their customers a new and urgently required service and make their distributing systems much more profitable by improving their load factor

Continental Markets for Domestic Appliances.

In this article we review the trading possibilities of British manufacturers of domestic electrical appliances in France and Spain.

IT is satisfactory to find that, impressed with the growing importance of the domestic electrical appliance industry, the Department of Overseas Trade has recently had carried out through British Consular officers a special inquiry into the present position of the use of such appliances in France and Spain. From the information thus brought together the Department has prepared two special reports which we have been privileged to peruse and from which we have extracted the information embodied in this article with the object of providing British manufacturers and merchants with some idea of the opportunities that exist for opening up business relations in the two countries.

The Position in France.

So far as France is concerned, in the capital city and certain of the large towns, such as Lyons, Bordeaux, and Lille, the use of domestic electrical appliances would appear to be quite as widespread as in this country and to be growing at an equally progressive rate. Although the market is being very extensively catered for by French manufacturers, the fact that German, Swiss, American, and also Swedish makers are all represented in the country certainly indicates that, despite the Customs duties and other handicaps that have to be met, British manufacturers should be able to secure a remunerative share of the trade if they would devote the time, trouble, and expense necessary to ensure success.

So far, however, it would seem that British makers have not given the French market serious attention, the Consuls in the different centres all reporting that British appliances and travellers are little known in the country. Indeed, the British Consul at Lille remarks in this connection that he met a trader in that town who informed him that, although for sentimental reasons he would like to handle British goods, he had never been called upon by a British traveller since he started in business in 1907! Only in one district—Nantes—do the Consular officers report any important proportion of British goods.

Handicaps to Development.

In some districts, Lille being one example, the high cost of electricity is said to be a hindrance to a wider use of electrical apparatus. Although the practice of supplying energy at power rates through separate meters is so far not very common in the country, certain enterprising supply companies are reported to be considering the question of encouraging the use of domestic appliances by the introduction of a special tariff. Moreover, in view of the rapid extension of power supply facilities not only in the towns but in the French rural districts, prospects all point both to a cheapening of the supply rates and consequently to a distinct widening of the market. As an indication of the extent of the business now available in France in connection with household electrical appliances, it may be mentioned that at the recent celebration of the completion of the first ten years of the activities of the Syndicat Français du Chauffage Electrique et des Applications Electro-domestiques, the president stated that the annual sales of such apparatus had in that period nearly trebled, and that in the near future the consumption of power for household purposes other than lighting would reach 500 million kWh per year.

After Paris, probably the town in which the use of domestic electrical appliances is most widespread is Lyons, this doubtless arising from the fact that the works of several manufacturers are located in that area and that they are all carrying on an extensive propaganda campaign. Generally speaking, vacuum cleaners and floor waxing and polishing machines are meeting with the largest sale, followed by electric irons, fans, kettles, and water heaters. There is not a very large demand for electric radiators and fires, owing to the increasing popularity of central heating in houses and flats. There is, however, business to be done in washing machines and in electrical appliances for hairdressing establishments. Except for up-to-date hotels no great interest is being taken in electric cookers, partly because of their initial high cost and heavy consumption and partly because of a conservative prejudice in favour of other forms of cooking ranges and stoves.

Price is, of course, an important item in determining the sale of electrical appliances in France, but another factor which has to be taken into consideration is that of the appearance of the goods. As one Consul points out it is often the housewives and not the men who have the final word in the purchase of domestic appliances, and that with the ladies appearance often counts for more than the durability or reliability of the article.

German Competition.

While urging that British makers should devote more attention to France, we do not overlook the fact that the French electrical industry is very powerful and well organised, enabling it to turn out satisfactory goods at relatively low prices; an indication of the importance of the French manufacturing industry is afforded by the fact that exports of French domestic electrical appliances now exceed the imports of similar goods of foreign manufacture. The existence of an important home industry has, however, not deterred two large German concerns from conducting active business campaigns in France and from opening their own showrooms in certain of the large towns, and it is merely stating the obvious to say that if Germany can do this there is no reason why British manufacturers should not secure a share of the trade. At present German firms are the biggest competitors of the home producers in France, the low prices which they are able to quote for goods that appear to be giving good service in actual use giving them a great advantage. American articles enjoy a good reputation for quality, but are not being so energetically "pushed" as those from Germany.

Trading Methods.

The different contributors to the report all agree that the best method to pursue for a British manufacturer desirous of opening up a trade with France would be first to send a capable French-speaking representative for a prolonged visit to the country to study the position on the spot, the investigation comprising not only the probable demand, but also the best methods of distribution, the most suitable designs of appliances, and the variation in the power supply in the different centres, &c. Following a personal visit of inquiry it would probably be found that the best method of opening up business in France would be to appoint a main agent or wholesale distributor in Paris—one who has a well-established selling organisation with sub-agents in each of the large centres. Such a firm, of course, would re-

quire a liberal discount in order to cover its establishment charges and make a profit, and at the same time to be able to offer retailers a trade discount of from 25 to 50 per cent. according to the class of goods.

An alternative method that is recommended in order to avoid paying twice the French 2 per cent. business tax and also paying income tax in both France and England is that of forming a small French "société anonyme," or joint-stock company, with a capital of about £8,000. The company should have a French name and be under the management of either a Britisher well acquainted with France and French conditions or a French general agent. In this way the British firm could allow the French branch a commission of 20 per cent. on the trade price and enable it to keep a large stock of goods on credit in France to enable the market to be methodically worked.

As regards the retailing of electrical appliances in France, although, as in this country, there are in most towns one or more retail firms specialising in the sale of electrical fittings and appliances, probably the largest number of sales are made by the large stores or "bazaars" which are to be found in all large centres, practically all of which have electrical departments. As already indicated the usual trade discount from list prices allowed to retailers ranges from 25 to 50 per cent., while the customary terms of payment are a cash discount of 2 per cent. for payment 30 days after the month of delivery of the goods and sometimes net in 90 days. In their eagerness for business certain German firms are stated to be allowing even more liberal credit terms, while, so keen is competition becoming, in some cases retailers will only accept electrical goods on consignment, payment to the manufacturer or main agent only being made after sale.

There are various points that must be borne in mind by any firm contemplating an attack on the French market. In the first place, there would seem to be a general idea in the country that while British articles are always of good quality they are correspondingly dear and out of the reach of ordinary buyers. Consequently this opinion will have to be combated by arranging with the main agent for a publicity campaign either by direct advertising or the distribution of circulars and catalogues, or both. Another important point to be borne in mind in trading in France is that not only must a stock of the various articles be maintained in the country from which the various sub-agents and, through them, the retailers can be promptly supplied, but that it is equally important that a good stock should always be on hand of such replacement parts as may from time to time be required. In the case of articles embodying special features these should be protected against imitators by means of a French patent.

The contributors to the report agree that all catalogues, booklets, &c., intended for distribution in France should be printed in French with prices quoted in the country's currency and dimensions in the metric system. Moreover, quotations to the main agent should be in francs and include c.i.f. French port, or, better still, delivery, including the payment of duty and other charges, right to the agents' doors, there now being shipping agents prepared to undertake this work.

The Spanish Market.

Despite a steady increase in demand, due mainly to the commercial activity of the firms already engaged in the trade, it cannot be said that, as yet, household electrical appliances are as popular in Spain as in England and some other European countries. For one thing the servant problem does not present the same difficulty as in other countries, there being an ample supply of cheap domestic help, while the servants and housewives still need a good deal of education as to the practical value of modern household appliances.

Although there are a few concerns in Spain now producing electric irons, kettles, and water heaters, the major portion of the sales in the country are of imported articles. Probably the most popular are those emanating from Switzerland, the goods being regarded as superior to, while no more costly than, those coming from Germany. American and Swedish makers are also competing for the business. Indeed, it may be said that Swedish-made vacuum cleaners enjoy the largest sale in Spain. The most successful of the foreign firms operating in Spain have strong locally-established subsidiary companies with a large staff of travelling salesmen who call on retail traders and even individual buyers. On the other hand, it would appear that so far British makers have not made any serious effort to secure business in Spain, what has been done being mainly limited to electric radiators and cookers.

Some Deterrents to Rapid Development.

Although the demand for electrical appliances in Spain is bound to go forward, it is unlikely that the progress will be rapid, for apart from the special social conditions and customs of the country—the Spanish people being inclined to cling to old methods—it cannot be said, speaking generally, that electricity supply concerns are as yet doing all they might in the way of assisting in the development of the use of domestic appliances. Madrid, Barcelona, and Bilbao are probably the three cities in Spain in which the use of domestic electrical appliances is at present most widespread. In the Bilbao district, however, although a supply at power rates is available, the price is regarded as still too high for a more general use of domestic appliances.

In the Seville district there is a small but growing demand for vacuum cleaners and radiators among the better-class residents. In the Coruna and Gijon areas, while there is little or no demand for electric radiators, fires, water heaters, and cookers owing to the high cost of electricity, an increasing number of vacuum cleaners are now being sold. In the Cadiz area, although some business is being done, the conservative character of the people, combined with dear electricity, are factors which limit the demand.

The Spanish Position Summarised.

To sum up the position in Spain it would appear that, apart from Madrid and Barcelona, a good deal of pioneering work has still to be done in the other large towns of the country and that meanwhile the two cities named, with perhaps the addition of Bilbao, are those on which any British manufacturers contemplating an attack on the Spanish market should concentrate. Such firms will do well, in the first place, to follow the advice given in connection with France—*viz.*, to send a capable representative to study carefully the special requirements and conditions of the country, subsequently deciding whether the establishment of their own direct Spanish branch or the appointment of a main agent or wholesale distributor in either Barcelona or Madrid is the more suitable. If the latter method is preferred care should be taken to see that the agent appointed has an adequate sales organisation with travellers conversant with the language and customs of the country, regularly visiting the sub-agents and chief retailing concerns.

Spanish importers, in view of the more liberal terms offered them by manufacturers in other countries, are to-day disinclined to fall in with the usual British requirements of cash against documents, confirmed credit references, &c. In this connection it may be mentioned that the two leading German manufacturers of electrical appliances who are devoting a considerable degree of attention to the Spanish market go so far as to supply wholesale houses with stocks on consignment with liberal payment terms. Trade discounts to retailers are usually from 35 to 40 per cent. off list prices, while the terms of payment range from 30 to 90 days. A feature of the trade in Spain is that power supply companies, while maintaining showrooms, do not as a rule engage in the direct sale of electrical apparatus but allow the use of the showrooms on agreed terms to importers for the display and sale of their goods.

Some Spanish Trading Points.

As in France, British goods are held in high repute in Spain as regards quality, but their prices are regarded as being above the competitive level. Taking the

market as a whole, it would appear that low prices and attractive appearance are factors of more importance than high quality, although it is obvious that if British articles are to be sold, their quality must be equal, if not superior, to the goods already on the market. To popularise electrical appliances in Spain, British makers will need to enter upon a publicity campaign either by newspaper advertising or by the use of the postal service which, in Spain, gives the advantage of a very low rate for printed matter.

There are two constructional details mentioned in the various reports that must be borne in mind. The first is that the heating elements in cookers and other appliances must be well protected, the widespread use of olive oil for frying purposes in Spanish kitchens having given rise to trouble with exposed elements. Secondly, small electric heating appliances for Spain should be fitted with the Edison type of socket or contact. Another point to be borne in mind is that both a.c. and d.c. are in use in Spain, and that in some towns the voltage of lighting circuits is 110 V and of power lines 220 V. As in all countries the question of having a stock of replacement parts as well as of the complete articles on hand in the country is of importance in Spain, a good deal of the success of Swiss and German manufacturers being the result of the attention which they have given to this matter. British firms must also be prepared to meet the heavy Customs duties now being imposed, 25 per cent. of which must be paid in gold. To enterprising firms, however, these should prove no great deterrents inasmuch as they are not hindering other foreign manufacturers. We may say that these two reports have been followed by one dealing with the subject of electrical contractors' supplies in France.

Electric Water Heating.

A comparison between the lines of development in Great Britain and Holland. Are restrictions on the hours during which current is used desirable or necessary?

By E. EAVES.

IT has been realised for some time by electricity departments and manufacturers that domestic electric water heating on the storage principle offers the possibility of a most valuable load, from the point of view both of sales and of improvement in station load factor.

The writer recently had the opportunity of discussing the subject in Holland, and he feels that a comparison of lines of development in Holland and in this country would be of value to all who are interested in the opening-up of this comparatively new field. The outstanding difference between the two lines of development is that, while in two towns alone in Holland over 20,000 water heaters are now installed, there they are mainly of the night-tariff type, while in this country the majority are installed without similar restrictions.

There are different methods of charging for this service in the two cities, Amsterdam and Rotterdam. In the former, water heaters are hired out to consumers at certain rates per month, the current being metered and charged at 0.4d. per kWh for night supply of current and 0.8d. for unrestricted supply of current. In Rotterdam consumers are charged a certain figure per month, depending on the size of the water heater, this figure covering hire, cost of plumbing and wiring, maintenance, and energy used. In other words, in return for a certain monthly payment, the consumer is allowed a certain predetermined amount of hot water per day. The latter is an attractive point, since the consumers purchase hot water instead of electricity to heat water. As a means of reducing the amount of capital invested in meters, &c., and of increasing the consumers' confidence (in view of the fact that there is a fixed liability per month) this idea is worthy of consideration in this country.

WATER HEATERS—ROTTERDAM.

Capacity in gallons.	Class of tariff.	Monthly charge. Hire and energy.	Energy only.
6½	Unrestricted	5s. 7d.	3s. 1d.
11	Night tariff	7s. 11d.	4s. 7d.
22	Night tariff	12s. 0d.	7s. 5d.
33	Night tariff	15s. 7d.	8s. 4d.
44	Night tariff	18s. 11d.	11s. 0d.

The drawback to the use of night-tariff water heaters is that, for a given hot water requirement in a particular house, the tank capacity will need to be approximately 2½ times the size required where there is an unrestricted supply of electricity. For example, with an unrestricted supply of electricity, and a 10-gallon water heater loaded to 1,000 watts and thermostatically controlled, it is possible to obtain a hot bath every morning and evening, and to meet average domestic requirements, approximately 30 gallons of water per day at an average temperature of 160 deg. F. To obtain similar service from a night-tariff water heater, a tank of at least 25 gallons' capacity would be required. In the average small house or flat a 20-gallon water heater of the conventional type usually meets requirements, but, to obtain similar service with a night-tariff water heater, a 50-gallon tank would be required, and, purely on the point of lack of suitable accommodation for so large a tank, this system is ruled out. Further, with the night tariff water heater, which usually embodies a ball-valve tank and magnetic valve, the apparatus is essentially somewhat complicated, while capital cost is increased and, owing to the increased tank surface, lagging losses are greater than with the conventional type of water heater in use in this country.

However, in spite of the above draw-backs it is felt that a certain acceleration of water-heater development in this country might be obtained in developing the night load, but, for the present at any rate, it is felt that requirements would be met by using the conventional type of water heater, which simply consists of the lagged container with removable apparatus plate, embodying withdrawable immersion heaters and thermostat. This would probably have to be 25 per cent. greater in size than the complicated night-tariff water heater to give similar results, owing to the fall in water temperature due to the mixing of cold water on the withdrawal of hot water. However, this fault appears to be more imaginary than real, as with a properly proportioned water heater, mixing of the cold water with the hot can be minimised.

The advantage of such a system is that the water heater may be of the semi-pressure type, and installed in the kitchen of a house or flat (fig. 1), feeding both the kitchen sink and bathroom taps; radiation losses from piping are minimised, as the one long run of pipe, namely, that to the bathroom, is filled with hot

water only once, or at the most, twice per day. In the case of the usual night-tariff water heater it is necessary for the water heater to be fitted above the highest point of withdrawal of hot water, and this is often most inconvenient.

Another important point, though no very exact data is yet available, is that the " clear of peak " feature can be obtained to all practical intent by the use of a conventional-type water heater having a given proportion between loading and capacity of tank, and embodying a thermostat which is not too sensitive, the range of operation being not less than 10 deg. F.

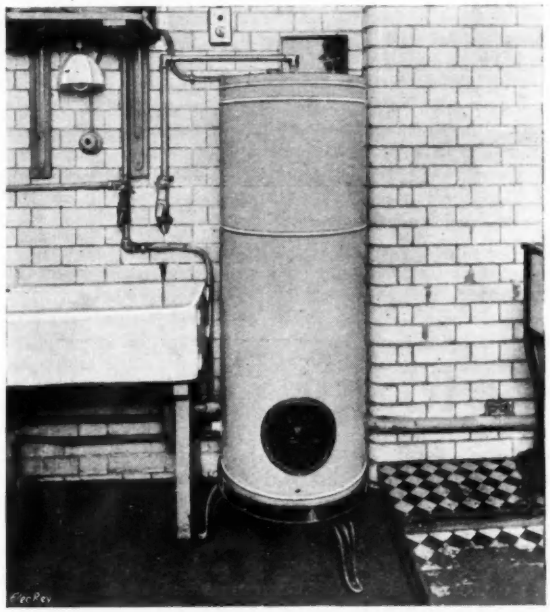

Fig. 1.—Floor-mounted General Supply Heater.

Where pressure of supply from the main storage tank in a building is too high for the standard water heater (in the case of high blocks of flats) a ball valve may be embodied in the water heater, but the writer feels that this should be avoided where possible, in favour of the use of the conventional simple type of water heater with a separate local ball-tap tank, whose capacity need not be greater than three gallons.

Thus, all the apparatus employed is easily understandable by the average plumber or electrician, and maintenance costs are reduced to the absolute minimum.

Following the above remarks, the writer would like to express the opinion that the developments taking place in England in connection with water heating are on sound lines, but would stress the point that wherever possible a simple conventional-type water heater should be employed, on account of both capital outlay and low maintenance.

Further, though the use of, say, a 20- or 30-gallon water heater in the kitchen of a house to supply both the kitchen sink and the bathroom requirements is the ideal general service system, where capital outlay is not all important a small water heater should be used in the kitchen and a large water heater in the bathroom, thus reducing running costs to the absolute minimum.

From recent experiences, it would seem that by the employment of a hire system with maintenance, rather than hire-purchase or outright sales, water heater business can be developed at a very great rate, and, if an all-in tariff is available with a " unit " rate of, say, ½d., there is no reason why the number of water heaters installed in the country in the near future should not be equal to the number of domestic cookers installed.

The above reference to water heaters for local rather than general supply might be amplified by pointing out that, by using two water heaters, one in the kitchen and one in the bathroom, of the one-point supply or open outlet type, rather than the one general-supply water heater in the kitchen, plumbing costs are considerably reduced. For example, in the case of existing premises, to install a general-supply water heater, with expansion pipe to the main storage tank in the roof, costs, roughly, £5 for plumbing, whereas an average figure for the installation of about 200 water-heaters in a certain district in this country of the one-point supply type, including both plumbing and wiring, is only 35s.

To a great extent, the final decision as to whether present lines of development in England are correct will depend on whether it is found that the simple type of water heater described earlier in this article, and installed under average conditions, avoids the station-peak period, and any data obtained under this head will be of very great value to supply undertakings, contractors, and manufacturers concerned in water-heater development. Manufacturers would, no doubt, be pleased to embody any improvements required to bring about this state of affairs, for example, a change in proportion of loading to capacity of tank, a variation in range of operation of the thermostat, and the disposition of the latter relative to the heaters.

One great drawback to the pure night-tariff system is that, in a certain house, the hot-water supply might run out before the end of the day, without any means of recuperation, in which case the news would spread in the particular district, and development in that district would be retarded. If booster heaters be installed to overcome this fault, the added cost for apparatus would be prohibitive, while the day energy would have to be metered separately, and charged at a higher rate, of course, than the ruling night tariff.

If it is possible to develop the field on a large scale on the lines indicated, the results will be very satisfactory to everybody concerned. Consumers will obtain adequate hot-water supplies at low rates, and with trouble-free apparatus; undertakings and electrical contractors will be handling popular apparatus with low maintenance costs; the load factor of supply stations all over the country will be greatly improved; manufacturers will have a very satisfactory production line, and will be able to get together to a certain extent, so far as standardisation of types and simplification of lines is concerned.

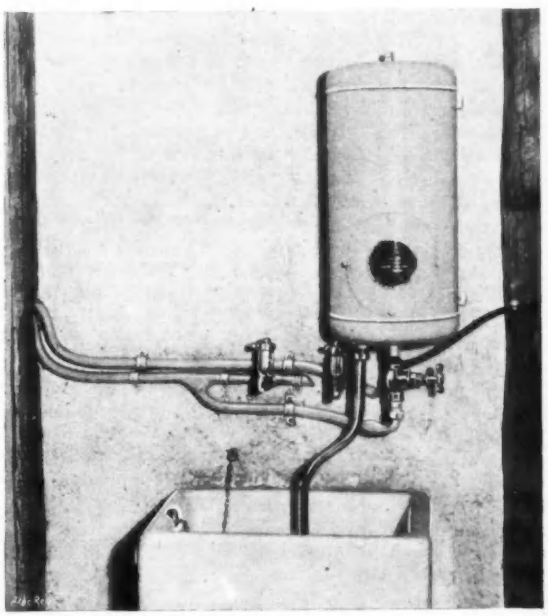

Fig. 2.—One-point Supply Open-outlet Heater.

Conventional water heaters of the type above described are illustrated in figs. 1 and 2. Fig. 1 shows the floor mounted general-supply type of water heater, while the one point supply open-outlet type water heater is illustrated in fig. 2. In all cases the water heaters should be sufficiently lagged, and precautions taken to reduce radiation losses from piping to a minimum, while the one-point supply water heater should embody an anti-

drip device to take care of the expansion of the water during heating-up.

Further, the water heater should embody convenient means for cleaning out the deposit in hard-water districts. It might be mentioned that by arranging the thermostat setting to keep the water temperature below a certain limit, say, 160 deg. F., in particularly hard-water districts, intervals between the cleaning may be greatly extended; by employing horizontal heaters of the type illustrated, this interval may be further extended, as a considerable amount of the fur deposit builds up on the base of the tank rather than on the heater tubes if these latter are fixed at a reasonable distance above the base of the tank. The use of horizontal heaters with thermostats, as above described, gives ideal facilities for the design of floor-mounted type water heaters (fig. 1), and these, while of neat appearance and having sweeping space underneath, provide facilities for cleaning on removal of the apparatus side plate.

Now, the final point to instill confidence is the reasonable cost of obtaining hot water electrically. In a certain case of new property, the cost of installing gas storage heaters complete worked out at £30, while the cost of installing general-supply electric storage water heaters of similar capacity worked out at £24; in each case was included the plumbing, and in the case of the electric water heaters the wiring. The average cost per week for hot water by means of the gas storage heater was 4s. at 9d. a therm, while the same service was obtained electrically for 3s. 6d. at a current cost of ¾d. per kWh.

It is hoped that the above will give information to engineers who have not yet had time to devote to this particular development, and stress the point that, though in this particular field some valuable development work has already been carried out, the possibilities for the development of electric water heating in the future are immense.

Electric Welding.

A Survey of the Recent Remarkable Developments in its Industrial Applications.

By E. W. LEWIS, M.A., Ph.D.

REMARKABLE developments have recently taken place in the industrial applications of electric welding. These appear mainly in the construction of steel-frame buildings, cruisers, merchant ships, pipes, aircraft, steel bridges, gas holders, oil tanks, tunnel shells, high-pressure vessels, rear-axle housings for automobiles, metal-refining kettles, aluminium work, radio-electric towers, turbo-generators, the grid wire of radio valves, and electrical machinery, and also in electro-forging and repair work in general.

The outstanding advancement in arc welding has been the commercial production of electrodes and the development of processes which produce ductile welds, both automatically and by hand. Electrodes are now being made of vanadium, nickel, and chromium. Important progress has been made in the methods of inspection of welds, employing shadow photographs obtained by X-rays, together with electrical resistance, magnetic, and vibration methods. The "fluid-fusion" arc-welding process has been developed in the United States, and recently a welded pressure still, 33 ft. by 8 ft., with a shell thickness of 4¼ inches, the elliptical heads being 4¾ in. thick, has been "fabricated" by this process; the test pressure was 1,600 lb. per square inch. Another example is a rotary kiln 12 ft. by 300 ft., weighing 275 tons; this probably represents the greatest volume and longest length of any completely welded vessel made to date.

Several fundamental developments in electric welding processes and applications have recently taken place in France; these include a method of welding in naval construction, reinforcing cast-iron bridges by using metal braces welded to castings, and welding in the construction of large barges for the transport of corrosive chemicals such as caustic soda. Thun and Halpert at Berlin have taken high-speed kinematograph films of welding operations, and studied them at low-speed motion; these have provided valuable information on the formation and transmission of the globules of metal passing from the electrode, the most favourable current conditions, and the influence of the type of metal and electrode.

Arc Phenomena.

Considerable research work has been carried out in America within the last two years on the metallography of arc welds, the fatigue of welded joints, stress-strain characteristics of welded joints, stress-distribution measurements, and stethoscopic and X-ray methods for the testing of welds. Fatigue tests on arc-welded material have shown the endurance of the deposited metal to be at least 10 per cent. above that of the neighbouring material, together with the complete absence of any tendency towards electro-chemical corrosion. Theories have been advanced regarding the strength of welds as affected by the quantity and disposition of the deposited metal, and, on the basis of these theories, design data have been evolved; this is an important step in establishing the theory of stresses in welds. However, information is still lacking with regard to fatigue of welds at high temperatures. Strelow has called attention to the difficulties of investigating what occurs in arc welding. The most accurate method of investigation is a photographic one, using an oscillograph to measure the current and voltage variations. The method indicates that, as the length of the arc changes, considerable alteration in the shape and in the amount of the material transferred occurs, and that the appearance of the arc alters with change of polarity; it also indicates the effect of covering the electrode with other materials. Such investigations into the transfer of metal are of interest, apart from their importance in welding, as they may throw further light on the nature of electricity.

Automatic Control.

A new portable arc-welding machine with two heads and with which very high speeds are attained has been produced in the U.S.A. For welding ½-inch plate the seam is prepared by bevelling to an angle of 30 deg. total opening. With 3/16-inch electrodes and approximately 250 to 300 A in each arc, a speed of welding of from 5 inches to 7 inches per minute can be obtained; thus, the speed of welding is approximately ten times that obtained with a single arc manually controlled, and the resulting metal is of better quality, because of the decreased chance of burning the weld.

Automatic welding is coming more into general use. An automatic welder recently placed on the market is expected to contribute to the more rapid development of automatic welding operations in that the electrode is automatically fed at the requisite speed as determined

by the fusion of the electrode. This automatic variation of feed is not only sufficient to take care of the ordinary changes in the arc circuit due to the welding, but it will regulate relatively wide changes of current adjustments due to changing the welding procedure or to change in electrode size, which also necessitates changes in the welding current. A new type of welding electrode, which combines the characteristics of a fluxed electrode and the quality of bead finish and the clearness in handling of a bare welding electrode, has been introduced. The absence of "spottery" is one of the advantages claimed for this new electrode. The elimination of the erratic arc condition leads to the deposit of more material with the same consumption of electrode per kWh, and the electrode penetrates quickly and produces welds of high tensile strength of unusual ductility and elongation. The desirability of maintaining a short arc has now been established.

Marine Construction.

Electric welding has now reached a position of considerable importance in naval construction and repair work. In a recent issue of the *Iron Age*, Mr. G. K. Spencer describes an emergency in which welding was called upon to put a ship back into commission with the least possible delay. "During manœuvres in the Pacific, two destroyers collided whilst emerging from a smoke screen; boat davits and the end of a torpedo tube were clipped off. The ship was brought alongside the tender to the destroyer squadron for emergency repairs; within a few hours, portable welders had completely repaired both the davits and the torpedo tube." Arc welding is being used in the construction of the new German cruisers of the *Koenigsberg* class, and it is stated that, as a result of numerous tests, electric welding is also to be used in the construction of other cruisers, a battleship, and a fleet of destroyers. Electric welding has thus proved to be of international interest, since the weight saved by this process materially assisted the German naval authorities in successfully designing the mounting of 11-inch guns on their new 9,000-ton cruisers. The *Leipzig* (6,500 tons, 180 metres long), launched on October 18th, 1929, is arc welded; this vessel has given an increase in effective dimensions without additional weight, also greater fighting value, higher speed, and more space for accommodating the personnel. In the newly-constructed German cruiser *Admiral Von Spee* the hull has been welded into one solid body, a very big saving in weight being effected, as against riveted construction. The German Minister of Defence recently announced that a saving in hull weight of 550 tons had been effected in the construction of the cruiser *Ersatz Preussen*, which is another electrically-welded vessel.

Developments have also taken place in the construction of arc-welded merchant ships and yachts; the object in this case is principally one of reduction in cost, whereas in naval construction the object is to minimise the weight without loss of efficiency. Two merchant ships are now under construction by the Newport (U.S.A.) Shipbuilding Co.; the features of these ships are the completely welded inboard-shaft-alley bulkheads. The first rivetless cargo vessel, a 2,500-barrel oil tanker, was launched last April from the shipbuilding yard of the Charleston Dock Co., Charleston, U.S.A. The vessel, 120 ft. by 23 ft., with a 10-ft. draught, was constructed entirely by the arc-welding process, only nine workmen being employed.

The Corps of Engineers, U.S.A., is now building a fleet of three arc-welded steel motor boats for use as carriers and tow boats on the Mississippi River. This is the second fleet to be so constructed by the U.S.A. Engineers. The unique design and construction of these boats is a distinct tribute to the ingenuity and engineering skill of the Corps. In another field instructive examples are afforded by two 600-ton oil tankers, built by the Deutsche Werke, Kiel, one riveted and the other welded; the structural weight of the riveted ship was 208 tons, and that of the electrically-welded ship 144 tons; thus for equal dead weight the welded ship is the more economical. An all-steel-welded yacht hull is now under construction on the Pacific Coast, and will shortly be fit for service. Maintenance costs have been reduced considerably at Statem Island, the New York supply base of the U.S.A. lighthouse service, by the construction of elements for channel buoys at the base.

Steel-frame Buildings.

During the past twelve months very rapid progress has been made in the use of electric welding in the construction of steel-frame buildings. There are over 140 electrically-welded buildings in the U.S.A. The growing list of welded structures which thus far have all been successful is gradually impressing upon the public mind that electric welding properly employed is a serviceable adjunct in building construction, with the advantages of rapidity and quietness. Used in connection with multiple-storey buildings, the saving in dead weight is sufficient to enable the engineer and designer to add 25 per cent. or more floor to the structure without increasing the load on the foundations.

Amongst the recently-constructed electrically-welded buildings are: the Hotel Homestead at Hot Springs, Va., which has 11 storeys with a total height of 180 ft.; a 13-storey structure for the Southern Californian Edison Co. at Los Angeles, specially designed to provide for the contingency of earthquakes, all the wind and seismic bracing being arc welded; an electrically-welded city hall costing about £300,000 at Schenectady, N.Y.; and the new building of the Lincoln Electric Co., Cleveland, with a floor space of 20,000 square feet. The electrically-welded building of the General Electric Co. at West Philadelphia contains the greatest tonnage of welded steel, *viz.*, 987 tons. This building has several ten-ton travelling cranes operating on spans of 58 ft. to 78 ft., together with several 2-ton wall cranes.

An unusual and striking application of electric welding to structural steel is described in the *Welding Engineer*, June, 1929. The work consisted of alterations to a four-storey building and necessitated cutting holes through the existing floors, installing a row of beams at each floor level, and constructing a roof supported by steel columns. No bolts or rivets were used at any stage, the necessary joints being arc welded. Where possible, the welds were made in the workshop, and the remaining welds with the structure in position. The world's heaviest electrically-welded truss has just been completed by the Pacific Iron and Steel Co., of Los Angeles; it is 96 ft. long and 18 ft. high, having maximum chord stresses of 1,000,000 lb. Two large electrical manufacturers have already developed automatic machines for the arc-welding of the seams of floor plates after laying, and a public demonstration of this type of floor construction was viewed by the members of the American Institute of Steel Construction at Biloxi, Miss., on November 14th, 1929. Electric welding has been little used for large steel structures in this country, but there is an example in the recently-erected electrically-welded steel structure of the carriage-washing plant at Heaton of the London and North-Eastern Railway; the building measures 35 ft. by 20 ft.

Railways and Bridges.

An important recent industrial development was the decided stimulus electric welding received in its applications in constructional and repair work to tramways, railways, and bridges, which have been developed to a far greater extent abroad than in this country. The feature of the application is the scope presented for economy in reduction and weight of components. Very considerable saving in weight is obtained by the elimination of angle iron and other rivet details, and it is principally in this direction rather than in the greater strength or reduced production time that the advantages appear. It has been found possible to replace castings by "fabricated" steelwork, thus establishing structural advantages and substantial economies.

The Holt Bridge, near Worcester, of 150 ft. span, has recently been widened and reinforced, the method adopted being to introduce various steel members, which were electrically welded together and to the cast-iron parts and reinforced in position. The work was carried out without interfering with navigation or traffic, and the bridge is the first to be reinforced in this country by this method. Extensive use was made of electric field welding in the recent erection of railway bridges and underpasses on an extension to an electrified railway system at Melbourne, Australia.

For bridge-floor construction, a combination of steel beams with steel plates can be assembled that materially reduces the dead load of the structure and provides a lateral rigidity more satisfactory than any floor diagonals now used. Several drawbridge spans have already been designed with electric welding construction at a considerable saving in the cost of the structure. Bruff, at the Institute of Mechanical Engineers on October 25th, 1929, referred to the electric welding work carried out on the London & North-Eastern Railway. In one case the web plate of an old plate girder, which had corroded through just above the ballast line, had a plate strip welded on, this being the first piece of electric welding to be executed in connection with the north-eastern area.

Electric welding has proved to be a valuable aid in repairing worn crossings, since the work can be carried out without interference with the traffic; about 100 crossings have thus been dealt with by the L. & N.E. Railway district engineer at Newcastle alone during the last 18 months. Worn-out coal spouts have been replaced at a small cost when compared with that of the old method of cutting out worn plates and re-riveting. Signalling track-circuit bonds have also been successfully dealt with. The total cost of the strengthenings of three bridges on the L. & N.E. Railway has been only one-fifth of the cost of the complete replacement otherwise considered necessary. Bruff gives the following summary of the results already obtained by the L. & N.E. Railway:—(1) from the point of view of strength there appears to be little to fear so long as the weld metal is not stressed beyond a limit which depends in the main on the class of electrodes used; (2) the costs of strengthening old structures as well as new work both lie well below the cost of riveted work; (3) a low amperage should be used (not exceeding 100 A per welder), depending on the gauge and the type of electrodes used, thus avoiding high current consumption, instability of arc, overheating, irregular fusion, and coarse and crystalline structure, the latter being invariably a sign of brittle weld metal having low resistance to shock; and (4) when welding, the voltage and amperage should be kept low, for single-weld machines the maximum voltage being 60, dropping to 30 when welding, and for multiple-weld machines the voltage remaining constant at not above 45.

During the last three years a large number of steel sleepers having electrically-welded bearing plates have been laid on the German railways, and this type of sleeper has since been recognised as standard. In the *Railway Gazette* for April 11th, 1930, is illustrated in section a German steel sleeper with welded chairs for bulk-headed rails, and a similar welded-steel trough sleeper and fastening for a flat-bottom rail. Its construction has the following advantages:—(1) the sleeper has no holes from which cracks and corrosion start and through which grit and moisture find their way, and hence the shell is not weakened at the place where the greatest strength is required, *viz.*, in the vicinity of the rail seat; (2) the absence of holes and the additional strength afforded by the bearing plates enable the thickness of the top of the sleeper to be reduced, and in certain types of sleepers sufficient weight is saved to cover the cost of providing and welding the two bearing plates; and (3) the faces of the plate and the sleeper which are in contact are hermetically sealed, so that moisture and grit cannot enter, and hence corrosion and abrasion between those faces are entirely eliminated.

The advantages of the application of electric welding in the repair of tramway rolling stock is illustrated by a recent Belgian case, in which a tramway company found defects in the built-up side frames of 24 cars after a few months' service. The repairs were carried out at the rate of 30 minutes per car, the welding being done over an inspection pit by means of an electric arc.

Chemical Engineering.

The outstanding industrial developments of electric welding in chemical-engineering operations have recently been summarised by Booer in a paper read before the Society of Chemical Industry on January 20th, 1930. Reference was then made to the successful control of temperatures between 2,000 and 3,500 deg. C., and the applications of these high temperatures have been attended by remarkable extensions in the field of electric-fusion welding. Dealing with various types of steel, Booer found that in arc welding 20 to 50 per cent. of the manganese might disappear from the electrode, and that the carbon and silicon content of the deposit was always materially lowered. The following example of the deposit from a flux-coated mild-steel electrode illustrates the point:—

	Carbon. Per cent.	Manganese. Per cent.	Phosphorus. Per cent.	Sulphur. Per cent.	Silicon. Per cent.
Electrode ...	0.18	0.56	0.008	0.03	0.15
Deposit ...	0.12	0.23	nil	0.018	0.08

Considerable developments have taken place in the technique of the electric welding of monel and other acid-resisting steels, particularly in cases in which the welding of steel thicknesses in excess of $\frac{1}{8}$ inch are involved. In the arc process direct current gives the best results. The polarity should be reversed, *i.e.*, the electrode should be positive, and a special deoxidising alloy, consisting of silicon, manganese, and magnesium, should be applied in powder form to the work and to the electrode. An all-welded 100,000-gallon fuel-oil tank was erected last year at Rockford, Illinois, all the seams being arc welded; it is 20 ft. high and 95 ft. in circumference, the base being of $\frac{1}{4}$-inch plate, and the shell of 3/16-inch plate. Designs for a tank of 4,000,000-gallon capacity have recently been worked out in the United States. Retorts have been welded of $1\frac{1}{4}$-inch plate and up to 24-inch diameter and 36 ft. long for service at 1,740 deg. F., and petrol stills 8 ft. in diameter and 50 ft. long, tested to a pressure of 1,700 lb. per square inch and designed to operate at a temperature of 1,650 deg. F. A gasholder is now in commission at South Melbourne, Australia, constructed almost entirely by means of electric-arc welding; it has a capacity of 3,000,000 cubic feet, is 105 ft. high, and 200 ft. in diameter. Another similar structure at Fitzroy, with a capacity of 3,375,000 cubic feet, was completely erected in 16 weeks by 20 men.

The advantage of electric welding over acetylene welding is that the area heated during welding is more local, and hence the residual external stress is less; with acetylene there is also the danger of increasing the carbon content. Recent experience has shown that, wherever possible, welded articles should be resoftened prior to being put into service.

(To be concluded.)

Future Development for Welding.

In a paper on "The Replacement of Castings by Weldings," by Mr. P. L. Roberts, read before the Institution of Welding Engineers, it is pointed out that up to the present only the larger and more obviously suitable castings have been superseded by welding, but there are enormous possibilities in other branches of engineering, particularly in the more competitive field of small castings, as yet untouched. To name only a few of the latter, there are switch-tank covers, switch frames, motor end-brackets, rotor and armature spiders, hearing cases and brackets. Outside the electrical industry there are turbine cylinders, lathe frames, planer beds, tables, &c.

Electric Furnaces.

Their Application to Industrial Heating, with Special Reference to the Resistance Type.

By VERDON O. CUTTS.*

THERE were comparatively few men forty, or even thirty, years ago who were capable of visualising the wide application of electricity and the innumerable ramifications of its industry as we know them to-day. A vast majority regarded those few as enthusiasts and visionaries. It gradually dawned on all, however, that, by its aid, not only could a bell be made to ring, but lamps could be lighted and motors made to impart power to machinery. To-day, electricity is the universal source of light and power, both in the house and the factory, and is widely appreciated on account of its ready availability and susceptibility to control. Those of us who have worked for a quarter of a century or more in the application of electricity to industrial heating processes have similarly passed through the "isolation period," and can now point to commercial applications of electrically-produced heat in nearly every industry. Here again, the primary reasons for the rapid growth are those of ready availability and susceptibility to control. The future rapid growth in the adoption of industrial electric heating can no more be arrested than could the growth of electric lighting and power units be retarded in earlier days.

The industrial uses of electrically-produced heat are already so diverse and extensive, its growth has been so rapid, and its literature is so recent as to render it essential to limit the scope of this or any other contribution to the subject. It is therefore proposed to restrict this article to a consideration of electric furnaces of the resistance type and their various industrial applications.

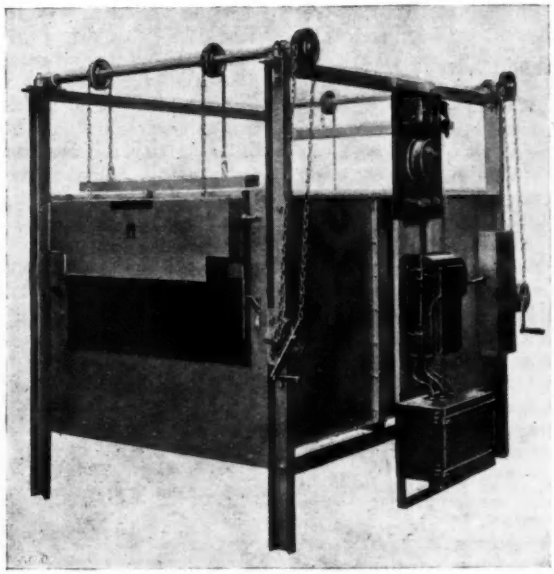

Fig. 1.—Furnace for Normalising Brass Pieces.

Growing Application.

The growth in the use of electricity for industrial heating purposes is definitely traceable along three distinct avenues. The first is the wider and more extensive use of the electric furnace by the trades which have been accustomed to its use from its inception; these are the heavier metallurgical trades. The second is the extension of the application of electrically-generated heat to many other industries and purposes. The third direction in which this growth is noteworthy is very significant and gratifying, *i.e.*, the larger unit size of individual installations. Along each of these three avenues it is obvious that extension and development are based on the best and surest foundation, that of successful experience. In this connection it is interesting to note the considerable extent to which the leading manufacturers of electric furnaces are using them in their own works.

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Precision in Heat Treatment.

The more general applications of electric furnaces are well known. Electric furnaces are applied on an extensive scale to the annealing, hardening, tempering, normalising, case-hardening, and the general heat-treatment of steel, and also for the annealing and normalising of brass, copper, aluminium, and a wide range of other non-ferrous metals and alloys. There has, in recent years, been an enormous growth in the development of special alloys, both ferrous and non-ferrous, for special purposes. The existence of so considerable a range of metals and alloys indicates that each one is intended for a precise application or purpose. This tendency towards precision has naturally brought in its wake a long series of heat-treatment specifications which are very rigid in their character. In fact, many of them are quite impossible of achievement, except in furnaces capable of working within a few degrees of a specified temperature and which are also capable of applying heat at that temperature with absolute uniformity throughout. The electric furnace not only enables these heat-treatment specifications to be carried out precisely, but it also enables successful heat-treating programmes to be repeated automatically. Some of the aluminium alloys must be treated at a temperature of 500 deg. C., but they would be ruined at 510 deg. C. In circumstances such as these the electric furnace proves invaluable.

Continuous-type Furnaces.

The early electric furnaces were all of the box or batch type, and it is significant to observe the marked tendency to-day towards continuous-type furnaces. In most cases the change is fully justified and merely involves the introduction of a moving hearth or other means of mechanical progression through the furnace. The conveyor and other moving parts in an electric furnace have a comparatively long life, owing to the fact that they are never heated to a temperature materially above that required in the charge. A more recently developed continuous-type furnace is used for the heating of metallic strip. The strip being treated is allowed to sag while in the furnace, where it is held by rolls at either end. Excellent results are obtained, but the length of such furnaces must be governed by the tensile strength of the strip at the operating temperature. Electrical heating lends itself admirably to this class of work. In the majority of cases the greater part of the heat input is required at the in-going end of the furnace, and electric heating elements may be disposed at will to suit these requirements. An interesting feature of a recent installation of this kind is that the furnace is controlled automatically, according to the temperature

of the strip passing through the furnace. In this instance the usual method of controlling the speed at which the strip passes through a constant-temperature furnace would not be sufficiently accurate. By controlling the electrical input to each section of the furnace, according to the temperature of the strip passing through that section, a difficult heat-treating operation is accomplished automatically and with consistently good results.

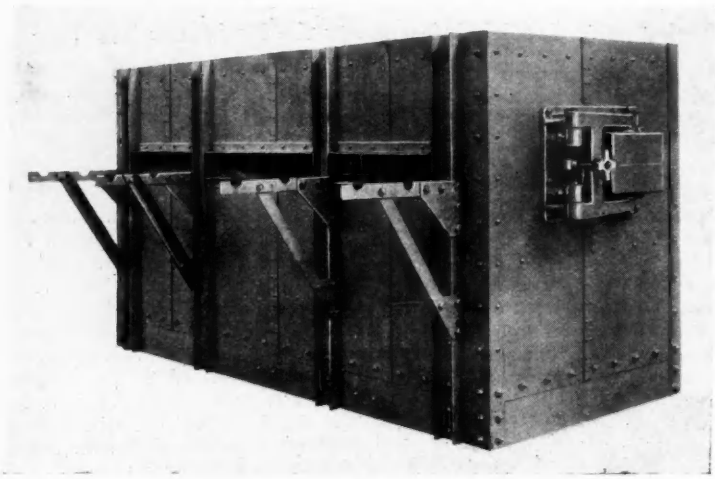


Fig. 2.—High-temperature Furnace in a British Columbia Mine.

Bright Annealing.

Much useful work has been done in recent years in the development of electrically-heated furnaces for the bright annealing of metals. One result of this work has been to reduce the cost of bright annealing, thus enabling it to be applied to a wider range of products. The use of artificial gas for this purpose has been dispensed with, but covers are still employed. Their weight, however, has been reduced by about 70 per cent., compared with what was formerly standard practice. Advantage is taken of the proven fact that if a charge is heated in a totally enclosed chamber, bright annealing can be achieved by preventing oxidation during the cooling period only. There are many such installations in regular commercial operation for annealing iron, steel, copper, brass, and nickel.

Vitreous Enamelling.

It is interesting to note the extent to which the electric furnace is being employed for the firing of vitreous enamels on sheet iron and steel in the hollow-ware, sign, and other trades, and on cast iron for sanitary ware and similar products. Modern practice calls for more uniform heat distribution and exact control of temperature than were possible with the old type of fuel-fired furnace. The upkeep costs of an electric furnace for this work are comparatively very small, whilst the absence of sulphur fumes and products of combustion is an important consideration. An improved product is obtained, a definite rate of production is maintained, and wasters are eliminated.

Resistance-type electric furnaces and ovens are being extensively adopted for numerous other purposes, such as the drying and baking of cores and moulds, the baking of japan, paint, varnish and lacquer, the sherardising of metals, and the annealing of glass.

High-temperature Furnaces.

A comparatively recent development of great importance is the electric furnace of the resistance type which is capable of working at higher temperatures than are possible with nickel-chromium heating elements. This has opened up an enormous field which has hitherto been untouched by the electric furnace. Typical applications include the hardening of high-speed steels, the treatment of certain alloys and austenitic steels, the melting of refractory metals, and the initiation and maintenance of chemical reactions for special purposes. Furnaces of this type of considerable size and electrical capacity are in regular operation under ordinary workshop conditions with completely satisfactory results.

Economic Considerations.

The foregoing is but a brief reference to the principal developments and comparatively recent tendencies in the commercial application of electrically produced heat. Such considerable progress has only been rendered possible by a growing appreciation of the fact that for many purposes and in many circumstances the electric furnace is capable of competing with fuel-fired furnaces on a straight-cost basis. This progress has been made during a period of severe industrial depression, and because this very circumstance has introduced the necessity for improved methods of production, improved products, and reduced overall costs. There is, therefore, the welcome inference that the old bogey of the comparative cost of fuels and electrical energy per B.th.u. content is exploded at last. The misunderstanding which has existed hitherto has done much to retard the progress of industrial electric heating, because prospective users of electricity for heating purposes were deceived by a half truth. There is now a growing realisation that comparative thermal efficiencies must be taken into consideration. It is perfectly true, for instance, that with town's gas at 3s. per 1,000 cu. ft. and, say, 475 B.th.u. per cubic foot the consumer actually purchases the equivalent of 13,195 B.th.u. for one penny, whereas with electrical energy at 0.5d. per kWh the value is but 3,412 $\times 2 = 6,824$ B.th.u. for one penny. The comparative costs of *applied* heat are, however, very different. Many electric furnaces are working at 80 per cent. thermal efficiency, and if we assume only 75 per cent. the figure of 6,824 is reduced to 5,118. To compete on an applied B.th.u. cost basis with this it would be necessary for the gas to be employed at a thermal efficiency of over 38%.

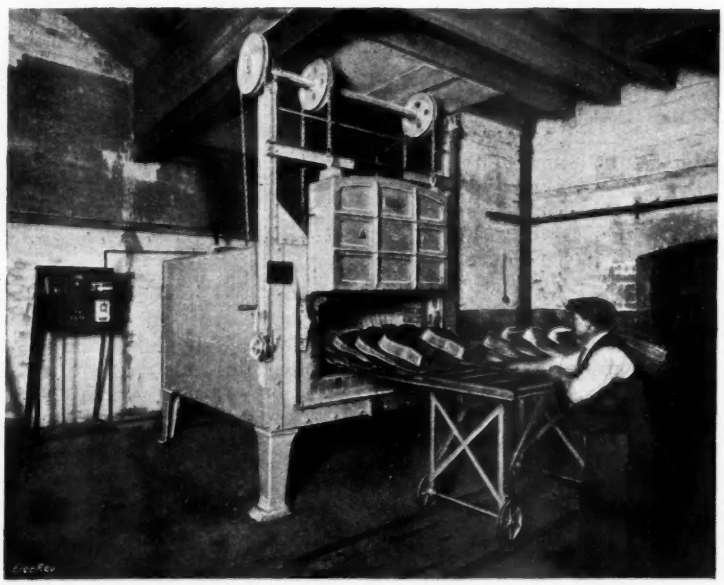


Fig. 3.—Annealing Furnace for German Silver, Brass, and Steel.

Nor is this all, as many other factors must be taken into consideration if a true evaluation is to be arrived at. The cost of delivering air in the correct proportion for combustion purposes must be added, and the many advantages which are peculiar to electrically-produced heat must be taken into consideration. With electric heating labour requirements are reduced to the minimum; in the case of manually-operated equipment, a simple switch operation is sufficient, instead of the more or less laborious, tedious, and often difficult regulation of fuel and draught. In most instances, with electric furnaces and ovens, the only labour required is for loading and unloading purposes. The benefits of availability and susceptibility to control referred to in the opening paragraph are important. The control is positive and precise; there is a definite relationship between electrical input and heat input which is not influenced by any secondary or extraneous considerations, such as apply to all fuel-fired furnaces. The application of automatic features is facilitated; pyrometric or thermostatic control is simple, positive, and dependable. The exactitude with which any heat-treatment programme can be repeated under ordinary shop conditions and without skilled labour is of far-reaching importance and has revolutionised works practice in many instances where repetition work is done on a considerable scale. There are many other features peculiar to the application of electricity for industrial-heating purposes which bring in their train important considerations when practically applied, but it is sufficient for the present purpose to indicate that these are tangible considerations which enable the electric furnace to meet economic requirements to an extent which justifies further study.

One feature of special importance, in view of the general tendency towards improved workshop lay-out, is the fact that an electric furnace or oven may be installed in the process line without regard to the position of existing flues. This reduces the manual labour necessary and avoids confusion.

An Ideal Electrical Load.

From a central station engineer's point of view the electric resistance furnace represents an ideal

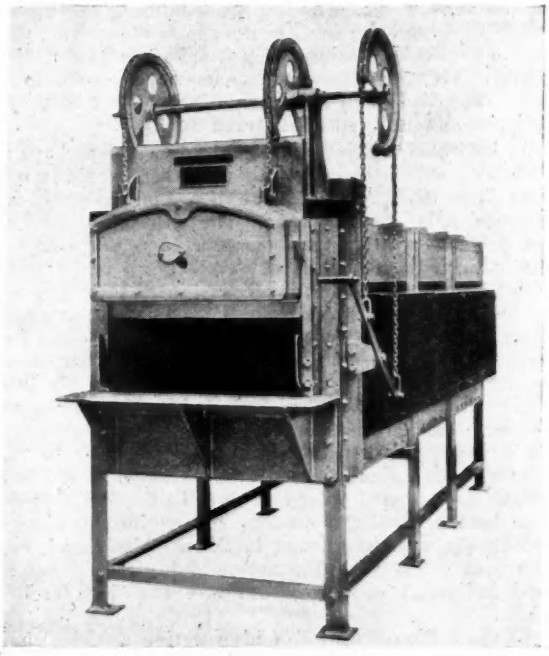


Fig. 4.—A Nine-foot Furnace working at 1,350 deg. C.

load, having unity power factor and a high load factor. From a consumer's point of view the character of the load is equally attractive, as it frequently serves to reduce the average price paid for electrical energy consumed throughout the works. To obtain the maximum benefit in this respect, it is frequently necessary to modify the organisation of the shop concerned, and it is essential that there should be wise correlation of the furnace size, its electrical input, its unit charge capacity, and its production capacity per unit of time.

Smoke Abatement.

The electric furnace represents a very important contribution to the subject of smoke abatement, which is now

Fig. 5.—Vitreous-enamelling Process.

exercising the minds of all consumers of fuel for industrial purposes. It is undoubtedly smokeless and offers, in addition, incidental advantages and economies which, in many cases, are capable of being expressed in terms of £ s. d. Industrial electric heating will doubtless materially assist the solution of the smoke problem and will go far to reconcile the equally laudable objectives of the metallurgist and the hygienist.

The future of the industrial application of electrically-produced heat is assured. In some cases it must await improved trade, in some districts it must wait until a fuller appreciation of the ideal load which it offers is shown by reduced rates, and in other cases it must await the obsolescence of existing plant; but in most cases it will ultimately be adopted as surely as the electric drive has been adopted in the past. The predominant reason in all cases will be its ready availability and susceptibility to control.

Standard Coal Specification.

The newly-formed North-Western Section of the Institute of Fuel held its inaugural meeting at the Engineers' Club, Manchester, on October 7th, when Mr. R. A. Burrows, deputy chairman of the Manchester Collieries, Ltd., was in the chair, and Dr. R. Lessing opened a discussion on the proposed British Standard Specification for the sampling and analysis of coal. It could be regarded as a useful stepping stone towards unification in methods for appraising and comparing the value of various coals for different purposes, and could be commended for general acceptance, both at home and abroad, by analysts and by the commercial and industrial interests which they served. By judicious revision dictated by the experience gained in daily use, any shortcomings of the present recommendations would be eliminated and a gradual tightening-up of the standards would follow. The obvious result would be that the coal trade, particularly the preparation branch of the mining industry, would pay increasing attention to the quality of its products and would thus enhance the good name of British coal which had been earned by its inherent properties, and maintain or retrieve it where this fuel was in danger of losing its reputation. A lively exchange of views ensued, in which members and visitors took part.

Tales Engineers Tell.

By J. E. WALLACE.
Assistant Secretary of the Electrical Power Engineers' Association.

ALL the tellable stories about electrical engineering come from mains and tramway men. The mere mention of lost vacuum, failing pumps or whipping shafts, sends a cold shiver through the station people and puts them to scared silence. On the other hand, if two or more mains men or tramway engineers get together the lore of their trade is endless.

In the very early days of electrical tramway development a certain city in the North advertised in the Electrical Review for an engineer and manager at a salary at which a sub-station attendant would now look twice. Of the aspirants four were chosen for interview, and it says much for the good judgment of the selectors that all these gentlemen are now executive heads of their respective undertakings.

It so chanced that they met and travelled for their interviews together, and were a little surprised when a cabman accosted them at their destination with a query as to whether or not they were the electricians. Having confessed, they took his cab to the Town Hall. There it was found that no arrangements appeared to be in hand for their reception. The Town Clerk was aware of their coming, but just who was to make the appointment was not clear. They had better go round together and see the chairman of the Gas Committee as that department ran the generating station! So out they went with a query to the cabman as to where they could find the Gas Committee's chairman. Yes, he knew, and bundled them into the cab. It turned out that the chairman of the Gas Committee knew no more than the Town Clerk. He sent them to the chairman of the Electricity Sub-committee, the cabman willingly undertaking to find that gentleman. Here, again, they were disappointed, and again the cabman trundled them off to find the chairman of the Salaries and Wages Committee, who was sure to know. Meanwhile they had jointly assured the cabman that they would have to insist on getting his increasing fare on their expenses for the trip. In the chairman of the Salaries and Wages Committee they ran to earth the information which they needed, and looking for which they had spent most of the day trundling about the town. "The appointment is to be made on the recommendation of a special appointments committee of the Electricity Sub-committee, which will be meeting to-day. The chairman is Councillor Thomas Thomson, who will give you all the particulars. See him." Out in the street they again consulted the cabby as to whether or not he could get them to the presence of Councillor Thomas Thomson. "Aye," said the cabby, "I can. I'm Tam Thamson." And he was!

It is not always easy to get engineers to talk of things that happened so far back. If you hint at their practical technical difficulties they reply that their whole work in the industry has been one practical technical difficulty. With one there is still vivid the difficulty of getting put up into sizeable packages the food for 20-hour week-end shifts.

In another undertaking a charge engineer, who has since hit the trail of success, found that his switchboard attendant had made a mistake in changing over generators. Only one was necessary to take all the load, and his error consisted of putting two isolators of the incoming machine with one isolator of the next panel which was for a machine out of commission; thinking he had closed three isolators on the incoming three-phase generator. When the outgoing machine was shut down the whole h.t. system was left running on two phases and therefore more or less single-phase supply. 'Phone consultations with district engineers brought no report of complaints. Luckily some rotaries were helping to keep the running three-phase plant on the system going; but starting would have been difficult, if not impossible. The charge engineer thereupon decided to push in the isolator on the blank phase and leave the issue to the gods. There was no bust-up, nor were there complaints or reports; and the engineers decided that the incident should remain very much closed. That was on the last day of the year. About Easter of the following year that charge engineer and four district engineers were notified to appear separately on the carpet. Their isolation was strictly maintained until all the interviews were completed. Who had squealed? The explanation was a recording chart from a consumer's motor which had turned up at the manager's office after a club conversation over a cigar, whereat the consumer had been relating some queer incidents of his lifetime which had included the story of a motor he owned, which for some 30 minutes appeared for no reason at all to develop nearly double the horse-power.

Taken off his guard, the charge engineer was brought to the confessional, but this being unknown to the outside men they stuck to their guns. They echoed "No complaints, nothing to report!" Afterwards standing in a row it was borne in upon them that the manager, marching backwards and forwards with his hands under his coat-tails, was alternating in his mind as to whether or not their valuable services were to be dispensed with. Still against his better judgment he overlooked the matter. He did like their schoolboy comradeship. When later that gentleman was knighted there were five men who sincerely felt he deserved to be.

As indicated, station stories are rare, and perhaps if we had consulted the hero of this one there would be one less still to tell. A northern town was on the eve of its first and only Zeppelin raid. The military had taken charge of everything, telephones included, and into the station with the full flush of authority an officer came with peremptory orders for all machinery to be stopped immediately. He would have no argument; engines, pumps, everything must stop now. And it was so! Then the boilers blew! Blew as never boilers blew before or since. The local populace from under their beds wondered much. They had had no idea that Zeppelins had such amazing powers, and the fear that row begot shook strong men's nerves for years. When it became known in the neighbourhood that no Zeppelin had been nearer than several miles and that the fiendish clamour had been a local production, the engineer-in-charge became the most hated man in the neighbourhood, and even yet meets with the envenomed glare of honest and indignant citizens who forget not that terrible night.

In the ordinary course of his vocation a mains engineer in a well-known undertaking was walking the streets with a triangle test set in one hand and a 'phone receiver in the other held to his head. As he placed his triangle on various selected spots of the street to locate a fault on an earthed cable, his movements excited no little amazement in two matrons in for the market. It was his bad fortune that the ladies should chance on an engineer from the tramway department to query as to what on earth the gentleman was doing, and that his reply should be confined to the simple action of screwing

his finger into his forehead and adopting a significant expression.

One of the dames thereupon took upon herself to chase away a crowd of watching boys with a "God help the poor fellow! Go away children, you brazen young brats, and leave the poor gentleman alone." And to her friend: "Glory be to God, Mary, what an affliction and him showing it off in the street like that!" There is still some enmity between the two departments.

It was on another system on an occasion when a manhole cleaning squad was operating on a line where the manholes were particularly deep that the men took it to minds to snatch a smoke before commencing operations, in despite of the rigour of a December day and a bitter north wind. When authority in the form of a staff engineer appeared in the offing, hurried steps were entered upon to make a show of progress. Up went the cover and no sooner was it removed than two bustling helpers lowered their fellow conspirator plop into several feet of icy water. In the exchange of pleasantries which followed, the engineer evolved the explanation.

While most experiences of engineers on any undertaking might be duplicated on another, the following must surely be unique.

The engineer who tells it was at one time shift engineer in a well-known reciprocating engine power station, only quite recently closed down. When going on duty he was calmly informed by the shift engineer whom he was relieving that one of the greasers had got across the bars and was dead. Urgent queries about the ambulance and doctors were met with the assurance that all that was no use. He was dead, and until they had further authority they had put him on planks resting on two barrels in the yard with a tarpaulin over him to keep the rain off. Fortunately other counsels prevailed and the dead man was back at work within a week.

It was in the same undertaking that a young engineer took it upon himself to connect an extra voltmeter to the 500-volt busbars in the rotary sub-station. Getting his spanner across the live busbars, there was a terrific explosion which fortunately blew our young friend clear but blinded him for several hours. The main busbar was melted to half its section.

His report given in his best style is still framed in the chief's office, its final paragraph being: "But, Sir, I'm glad to say that the voltmeter leads are not damaged."

From there, too, it was that a man was sent out with a temporary mate, only that day started, to put a fuse in the supply cut-out in a pork butcher's shop. The cut-out was in an awkward position under the butcher's counter. Under the counter to renew the fuse, the wireman began to kick in a manner most lively and to articulate as best a man could who was stuck on to the mains. To the anxious inquiries of the butcher's wife the temporary mate replied that obviously his mate was in a fit and was perhaps best left alone for a minute. Deciding, ultimately, to draw him out the new man was rewarded with a blow between the eyes accompanied by an earnest query as to why he had been left on so long. That temporary man is still wondering at the strange ways of electrical people.

Perhaps he is to be likened to the chief fireman at another town who protested that it was obviously needless to switch off the h.t. on premises they were called to vent their special qualifications on as the electricity could not possibly go up the water so quickly as it passed under pressure from the hose.

The necessary information would not be imparted to him with more feeling than was a small lecture on the virtues of being exactly observant recently delivered by a small group of mains engineers to a certain Yorkshire policeman. In the late hours of the night or early morning the mains engineer had answered the 'phone to learn that the police had found some smoke coming up from the centre of the road near the main distribution point.

It was a case of all hands to the trouble, and as each stalwart arrived in the raw of the November night he learned that as the asphalt road-makers had been laying a new strip the place where the large firepan had been situated was left very hot. A slight shower steaming on this had caught the vigilant eye of the man in blue. It needs not the assurance of my informant for us to know that the mains engineers then went to choir practice.

It was in another undertaking that, when two boilers were put on for the first time, a harassed shift engineer saw his steam walking back very rapidly. An interview with the fireman, who had never had two boilers on before, evinced the following explanation: "You've more than eighty pounds in each boiler, that gives you above a hundred and sixty. What more do you need?"

Just as every dog has his day so does every engineer have one that he vividly remembers. Within a certain ancient borough, better renowned for its racecourse than for its tramway system, the generating plant was a sorry collection of miscellaneous gear, particularly the boilers. Some 30 years ago the traction load on the principal two-day meet of the year was an annual problem to be solved with varying degrees of success each recurring winter. On the occasion under review the station superintendent had prepared for all eventualities and awaited the testing time with his plant fully primed. His chief was only an occasional visitor, but he came on the first morning to see that all was well for the great day. It was not. The water in the gauge glasses of No. 1 boiler was turgid—due to softening treatment. She must be blown, and, impervious to heartfelt protests, the chief himself operated the blow down valve key. The valve once open stuck open and nothing that could be done would close it. Off went the chief to the races, leaving directions about the valve being shut down as soon as possible. The boiler had to be taken off the range. With No. 2 on, the traction load was rising rapidly, and then tubes began to leak and No. 3 had to be substituted. The peak passed as the races started, and then No. 3 split a tube. Barely in time for the return load No. 1 was in commission again, only to promptly split a tube in its turn in protest at the rapid heating and cooling. While the superintendent was watching the voltage drop from his traction battery the chief slipped in on his way from the races to say that he would be away on business the following day.

That night was a hectic one for the station superintendent. His black gang looked upon race days as fair days, and the locality is not noted for its teetotallers. After a whole night of renewing tubes in boilers too hot for more than a few minutes' work at a time, the second and heavier day was to be faced with firemen who had celebrated race day, boilers unable to hold the proper pressure, and batteries over hastily charged. With depleted service, battery plates buckled, and under a continuous fire of consumers' protests the day was got through, with two boilers again out of service and another on its last efforts.

The superintendent, in revolt, unloaded his pent-up indignation so effectively that the chief and the chief assistant took over for the night. When the superintendent came in early next morning he found his two senior officers garbed in boiler suits with cowls drawn over their heads soundly sleeping in the coals on each other's shoulders while the steam was slowly rising for the morning load.

When listening to these yarns of an earlier day I had sometimes wondered at the easy facility with which some of the senior engineers found such ready comments so suitable to all circumstances. Perhaps the following confession from a scion of a clerical family who is now in high standing in the supply industry will help to explain this gift.

He was on a system equipped with the old telephones of a famous company which had earth returns. To ring up one of the staff meant ringing the lot, and it was discovered by the juniors on night shift that a casual call given in the early hours of the morning kept them well primed in anything new to be learned in the way of language.

Combustion Problems.

The pulverised-coal problem has been practically solved; properly designed plant is capable of an appreciably better efficiency than modern stoker-fired boilers.

By R. A. CHATTOCK, M.I.E.E.

THE great improvements that have been made in the burning of fuel under steam generators during the past forty years have been largely due to the advent of the public supply of electricity.

Prior to that the largest users of fuel in any one installation of boilers were the steamship companies. They were necessarily handicapped, owing to restricted space, as regards the types of boiler and the sizes of furnace that they could use, and those limitations militated against obtaining the high efficiencies that we now look for, as well as against the use of those cheaper qualities of coal which can now be burnt so efficiently by land installations. However, marine engineers have recently been striving to obtain greater economy by adapting the use of pulverised coal and of fuel oil, especially the latter, to their special requirements on board ship.

In the early days of electricity supply it was customary to follow land-boiler practice as developed in large textile mills, ironworks, &c., and to install boilers of the Lancashire or Scotch types. They were generally hand fired, and it was necessary to use costly high-class Welsh coal, or double-screened bituminous coal, to obtain the best results, whilst the cost of labour was also very high. The poorer classes of coal that were used in industrial concerns were found, when hand fired, to be unsuitable for electricity works, owing to their inability to meet the sudden demands and varying loads that had to be dealt with.

The development of the mechanical stoker was due to this limitation, and its application to the boilers then in use not only enabled the poorer classes of coal to be burned more efficiently, but also it increased the steaming capacity of the boilers by some 30 per cent.—a very valuable asset when the cost of floor space and buildings in congested urban positions had to be taken into account; the cost of labour in operating the boilers was also reduced by this method of firing.

Those improvements led engineers to consider how still further advancements could be made in the problem, and the adoption of the water-tube boiler, which had then just been introduced to this country, enabled them to obtain still better results, by concentrating more steaming capacity on the floor space available, and by increasing the cubic contents of the combustion chambers over what was possible with the Lancashire, or fire-tube, type of boiler. In this way more perfect combustion of the fuel could be obtained.

Various types of mechanical stokers have been tried out, by means of which the coal was pushed on to, or sprinkled over, the grate, which then conveyed it slowly to the back end, where the ash and clinker were deposited into an ashpit, from which it was periodically removed.

It was found to be impossible to prevent some of the carbon contained in the fuel from passing over into the ashpit in an unconsumed form, generally imprisoned in the clinker, and this varied from 8 to 12 per cent. of the total weight of ash produced, according to the design of the furnace, and constituted a definite loss correlated to this method of firing.

The mechanical stoker that has emerged from many years of experience as being the most efficient is the chain, or travelling-grate, type, although the retort type of stoker is now being developed to produce equally satisfactory results.

In order to obtain still more perfect combustion of the fuel, engineers turned their attention to burning it in a pulverised form, ground to such a fineness that each particle, as it entered the furnace in conjunction with the necessary volume of air needed to promote complete combustion, would be instantly consumed. A large amount of experimenting has been carried out to determine the various factors that go to make up the best and simplest arrangement. These factors are:—

(1) The best type of grinding mill to obtain the neces sary degree of fineness.

(2) The necessity for drying the fuel before pulverising, and the percentage of moisture that can be allowed to remain in it to suit various operating conditions. This is a very important factor, as upon it the type of plant to be installed largely depends. For instance, if on the one hand it is desired to convey and store the pulverised fuel before it is fed to the furnace, it is necessary to reduce the moisture content to a figure not exceeding 6 per cent., otherwise trouble will be experienced with clogging in the conveyors and bunkers; if on the other hand the fuel is to be blown from the mill through short lengths of piping direct into the furnace, and heated air is to be used for this purpose, it appears to be quite unnecessary to dry it at all, and all the pre-drying complication can be avoided.

(3) The cubic contents of the combustion chamber necessary to obtain the best results. This factor depends largely upon the design of burner that is used. The old pattern of "fish-tail" burner, which produced a long flame, required a very large furnace in which the heat release per cubic foot per hour was about 11,000 B.th.u. The more modern pattern of "turbulent" burner, which produces a short flame in which full combustion is obtained within a foot or two of the orifice, enables a furnace of about half that size to be used, in which the heat release per cubic foot per hour is about 22,000 B.th.u.

(4) The design of the furnace walls and bottom. Originally these were of firebrick, cooled by building them hollow and drawing cold secondary air through the space so formed; as a result of this arrangement it was found that the ash slagged on the firebrick, and the latter was rapidly burnt away if the temperature in the furnace was allowed to rise too high. It was not safe to allow the CO_2 content of the gases to become greater than 10 per cent., which meant a great excess of free oxygen and a poor furnace efficiency. The ash also slagged in the furnace bottom, causing continual trouble and necessitating stoppages in order to remove it.

The cooling of the brick walls and ashpit by means of water or steam tubes, which formed part of the circulation system of the boiler proper, was the next development, which to a large extent got over this trouble, allowed a higher furnace temperature to be safely maintained, the CO_2 content of the gases to be raised to 14 per cent., and the efficiency of the furnace and boiler to be greatly improved. Even this improvement, however, did not enable sufficiently perfect combustion to be obtained, as, if the CO_2 was raised above 15 per cent., trouble was experienced with the brickwork, and maintenance costs began to mount up again.

The most recent design of furnace aims at dispensing with brickwork altogether by using a screen of steel plate

between the tubes, or by building the brickwork entirely behind the tubes, which are spaced nearer together in order to protect it. This arrangement enables a still higher furnace temperature to be safely carried, and a CO_2 content as high as 17 per cent. to be used.

So far that is the best that has been done, and it enables a boiler efficiency to be obtained very considerably higher than the best mechanical stoker will allow.

It would appear from the present state of our knowledge of the subject that the best and simplest arrangement consists of :—

(*a*) A water-tube boiler having vertical tubes to eliminate the necessity of soot-blowing so far as is possible, equipped with a super-heater capable of raising the temperature of the steam generated to a total of 750 deg. F. at the overload rating. The boiler and superheater should have sufficient heating surface to reduce the temperature of the furnace gases to a figure that would enable the air heater to function as specified.

(*b*) A combustion chamber with its walls formed of vertical water tubes, containing as little brickwork as possible, the bricks being all of standard sizes and designed to operate continuously, without undue maintenance cost, with a CO_2 content of the furnace gases of 17 per cent.

(*c*) An air heater that will heat both the primary and secondary air to a temperature of 400 deg. F. at all loads, with a leaving-gas temperature at full load not exceeding 275 deg. F.

(*d*) Two or more " unit " pulverising mills, according to the size of the boiler, each feeding independently its own burner in the furnace, and suitable for being air-swept with air at a temperature of 400 deg. F.

The ash residue should not contain unconsumed carbon in excess of 3 per cent. of the weight of ash produced.

With a plant designed on these lines it should be possible to obtain a boiler efficiency of 88 per cent., which is considerably better than the results obtained from a modern boiler installation equipped with mechanical stokers.

At the same time the capital cost of the equipment should not exceed that of a stoker-fired layout by more than 5 per cent. at the present time; later on, when further simplification is developed, there should be no difference between the costs.

The superiority of pulverised-fuel-fired boilers over stoker-fired boilers becomes greater as the coal used becomes poorer in quality. With high-class clean bituminous coal having a calorific value of from 11,000 to 13,000 B.th.u. per lb., excellent results can be obtained from mechanical stokers, and a boiler efficiency of 84 per cent. should be possible. With poorer-class coal having a calorific value of from 8,000 to 10,000 B.th.u. per lb., and a higher percentage of ash, mechanical stokers do not function as well, and the boiler efficiency drops to about 80 per cent., or even lower.

The attraction of using the poorer-class coals is, of course, their lower cost per ton. One drawback attached to the use of poor coal is its high ash content, usually from 15 to 20 per cent., which not only causes greater wear and tear of the mills, but also increases the quantity of dust that passes through the boiler and has to be trapped before it can reach the chimney. The dust trouble is more difficult to eradicate in the case of pulverised-fuel firing than stoker firing, because the dust formed is so very much finer, much of it being more of the nature of smoke than dust.

The coarser particles can be efficiently caught by means of cyclone collectors, which can be relied upon to trap from 90 to 95 per cent. of this material. The finer particles are, however, more elusive, and not more than 70 per cent. of them can be caught in the cyclones; the rest becomes very apparent at the chimney top, and creates a bad impression upon the public mind. The only means of trapping this fine material is to use high-pressure water sprays in special chambers through which the gases pass with a low velocity. Such spraying can be relied upon to remove practically the whole of what gets past the cyclones, and to ensure that nothing can leave the chimney that could be regarded in any way as a nuisance.

The pioneering work that has been carried out with pulverised-fuel firing in several towns, such as Birmingham, Derby, Brighton, Leicester, and Peterborough, has been very valuable in furthering the development of this economical method of consuming fuel, and, whilst there are probably further improvements to be made, it is evident from the excellent results that are now being obtained that the problem has been practically solved.

Pulverising Equipment.

Observations Bearing on the Maintenance Problem.

THE maintenance of coal-pulverising equipment differs from that of stokers in that it is influenced more by the kind of coal than by methods of operation. The abrasive characteristics of the coal, which are influenced by impurities such as pyrites, slate, &c., that it contains, have a direct bearing on the life of the pulverising elements.

With a fixed kind of coal there is little that can be done to decrease maintenance. It is a fact, however, that if certain types of machines are overloaded or underloaded the maintenance will be increased. With any type of mill attention to lubrication has an important bearing on the upkeep. Adoption by various manufacturers of oversize, anti-friction bearings wherever possible, together with improved methods of sealing the bearings against dirt, and improved methods of lubrication, have been a big factor in reducing maintenance costs. With mills so equipped the maintenance charges, other than for grinding parts, can be kept low.

With proper care in operation a complete overhaul of a mill, other than to replace grinding parts, should not be necessary more than once a year. At that yearly overhaul the mill should be completely dismantled, so that every part can be thoroughly inspected and the necessary replacements made. Wear on bearing and shafts should be checked, with special attention to the thrust bearings on vertical-type mills. It is now the practice in many installations to build up small bearings, shafts, and other parts by welding.

Good results are being obtained with mild-steel blades having strips on the face at right angles to the direction of flow. These strips, generally of stellite or steel welding rod, are made approximately $\frac{1}{4}$ in. in height and spaced 1 to $1\frac{1}{2}$ in. apart. Corrosion is also a factor in the life of fan blades, particularly if moist coal high in sulphur is handled, but the use of strips on the blade face has materially lessened that action. To reduce wear on the exhauster blades to practically nil in one system the fan has been placed on the return side of the cyclone collector. In this position only from $\frac{1}{2}$ to 2 per cent. of the coal is handled by the fan. It also makes possible the use of a more efficient fan.

Based on a study of a number of installations using both the storage and unit systems handling Eastern bituminous coal, the cost for maintenance (labour and material) is stated, in a recent article in *Power*, to vary between 2d. and $3\frac{1}{4}$d. per ton of coal milled. With lignite this charge is around 1d. to 2d. per ton.

Rural Development.

The economic necessity for the use of overhead feeders and distributors; examples of special designs of over-head lines and sub-stations; statistics from a typical village scheme; and the effect of electrification on the decentralisation of industry.

By J. T. H. LEGGE.

(*Managing Director of the Shropshire, Worcestershire and Staffordshire Electric Power Co.*)

THE problem of developing electricity supply over tracts of rural country is one that has been receiving the attention of electricity supply undertakings for several years. There are many difficulties to be overcome in providing and popularising rural electrical service, not the least being the inherent caution of the residents in quickly taking up new ideas.

Wide distribution cannot pay if the energy is to be used for lighting purposes only, and, further, any considerable development for purposes other than lighting can only be obtained at prices that are comparable with those in the medium-sized towns. It is, therefore, essential that the capital cost of taking the supplies to rural communities must be reduced to the lowest possible figure. It is now generally accepted that the establishment of extra-high-pressure power lines, constructed overhead and served from an efficient central generating station, provides the most economical scheme by reason of the comparatively low capital expenditure, and also the economic running cost. Generally speaking, in the past such high-pressure distribution systems have been constructed chiefly to afford additional supplies to heavily populated centres, to avoid the extension of small generating stations.

The first problem that had to be settled was whether the principal lines of the transmission system should be planned as feeders working at a high voltage to serve the heavily populated centres, with distribution at a more moderate pressure radiating from those centres, or whether, in the first instance, the power lines should be designed to work at such a pressure, and pass along such routes that, in addition to affording the additional supplies to the heavy load centres, they could be readily and economically tapped to provide energy for villages and even individual consumers *en route*. Consideration of the lower capital charges during the initial stages of development, coupled with the scarcity of reliable data at that time as to the load obtainable in rural areas, induced the Shropshire, Worcestershire and Staffordshire Electric Power Co. to adopt the latter-mentioned alternative, and in consequence a network of approximately 350 miles of e.h.t. power lines has been established, operating at such a pressure (mostly 11,000 volts) that tappings can be taken at a reasonable cost.

With the load thus developed, the necessity for establishing high-voltage feeders to augment the 11,000-volt distribution system arose, and the construction of such lines has now been proceeding for some time. It has been decided that pressures of 33,000 volts and, where the length of feeder is excessive, 66,000 volts are most suitable for this work, and the necessary switching and transformer stations are of the outdoor type.

Reverting to the 11,000-volt power line system (as distinct from these last-mentioned feeders) the electrical load *en route* has been served by the construction of "spur" lines feeding the belt of country adjacent to the power lines for a distance of four to five miles either side. Some three or four years ago a number of these spur lines was constructed for service at 3,300 volts, but the tendency recently has been to discontinue the construction of these "spur" lines for the lower working pressure, and to deal with all such rural extensions at 11,000 volts. Up to that time 3,300-volt lines for subsidiary extensions showed a saving in cost as compared with lines operating at 11,000 volts; copper conductors of small cross sectional area were employed, and the lines were designed to transmit 250 kW over a maximum route length of five miles.

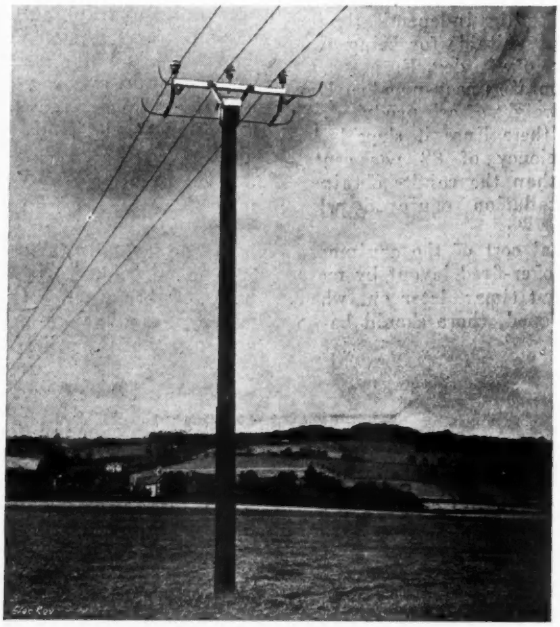


Fig. 1.—11,000-volt Power Line with Galvanised-steel Conductors.

The evolution of a simple and cheap form of construction for 11,000-volt rural "spur" lines, together with the advance made in recent years in the manufacture of inexpensive conductors quite satisfactory for short-length transmission, have had the effect of reducing construction and maintenance costs of lines of this pressure to a figure below the cost of 3,300-volt copper-conductor lines. These 11,000-volt rural "spur" lines are designed to transmit 200 kW over a distance of five miles, and their routes are planned, when possible, links between two or more existing lines, catering for supplies in the areas lying between these lines, and ensuring that duplicate feeds will be available. Galvanised stranded-steel or copper-covered steel conductors are employed with a maximum span of 360 ft.

As will be seen from the photographs accompanying this article, the 11-kV rural lines are simple and neat. The pole-top construction enables pole lengths to be reduced to a minimum, and it will be noted that stay wires on single angle poles can be attached in the correct position at the top of the pole, without affecting the requisite clearance from the conductors. No continuous earth wire is employed, each pole being provided with an earth plate to which the earthing bars are connected (fitted at each pole). Insulators are fitted with cone-seated spindles, the conductor clearance from the

channel arms being 10¾ in. "H" poles are used for angles having over 12 deg. deviation from the straight line. The cross-arms for single and "H" poles are interchangeable and all channels are drilled to enable duplicate insulators to be fitted where required. This standardisation of detail may seem of small importance, but it has been found in practice to effect a distinct economy in the cost of construction.

Rural sub-station design is a matter that still requires development with a view to lowering capital cost. Oil switch-fuse units have been extensively employed for protecting transformers in outdoor sub-stations where the capacity of the transformer is 50 kVA or over, the switch-fuse, transformer, and low-voltage distribution fuse box being mounted (on a small concrete mat) at the foot of the pole tapping.

Single-phase and three-phase transformers up to 25-kVA capacity of the pole-mounted type are now being standardised, the drilling of the channel irons supporting the transformers being identical for all sizes of transformer. Where transformers are installed subsequent to the erection of the high-pressure distribution line, they are usually mounted on separate poles. The transformer is provided with tetrachloride fuses on the high-voltage side. This practice has followed a series of experiments that has been carried out during the past three years at the company's central workshops, and fuses and switchgear of various designs have been subjected to tests of a severe nature, which have shown that the liquid type of fuse is the most satisfactory in operation, due to its high rupturing capacity and rapid action. In the event of a fault the minimum of disturbance is caused to the system. In collaboration with several manufacturers considerable work has been carried out towards the development of a satisfactory "pull down" switch-fuse unit, and experiments are proceeding.

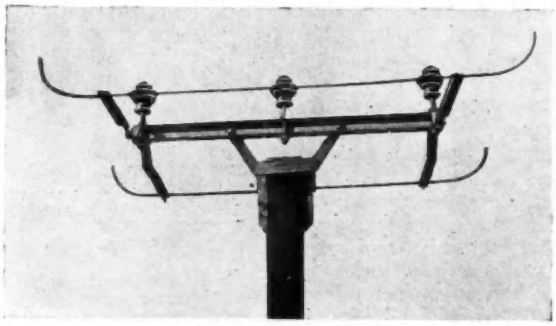


Fig. 2.—11,000-volt Galvanised-steel Wire Power Line; Pole Top Equipment.

The problem of economic low pressure distribution is one on which articles and extensive data have appeared in the pages of the Review from time to time. It will, however, no doubt be of interest to analyse the characteristics of the electrical load obtainable. For this purpose the Shropshire, Worcestershire and Staffordshire Electric Power Co. has kept records, and at intervals of two years a census of the connections to the mains and maximum demand has been obtained from a typical village. Table I gives details of the results.

It will be seen that seven months after the supply had been established the load factor of the village supply was 7.9 per cent. Two years after it had risen to 9.7 per cent., while with the expiration of a further two years a load factor of 14.9 per cent. was obtained.

The village in question is one that has no industrial power load. It has no established shopping centre, there being merely a few general-purpose shops, the major part of the retail business being carried out in a town some 3¼ miles away. All low-pressure distribution is carried out overhead, the pole fittings being made to the Shropshire, W. and S.E.P. Co.'s standard design.

A point that will be particularly noticed from the census is the growth of the heating and cooking load, which has resulted in the sale of energy during the two summer quarters being practically equal to the sale during the two winter quarters. The diversity factor of village load is very high, as, although after 4½ years of development over 670 kW of apparatus was installed, the maximum demand was but 77 kW.

It is usually found in developing a rural area that there is considerable diversity in the type of load met with. Apart from the domestic load in the villages and the supplies to farms, in the rural portions of the company's area supplies have been afforded to the following classes of consumer: breweries, brickworks, collieries, flour mills, fruit canning works, quarries, saw mills, sewage pumping stations, sugar beet works, water pumping stations, wholesale dairies, agricultural implement manufacturers, boot and shoe manufacturers, button manufacturers, cider manufacturers, pre-cast concrete factories, electric battery manufacturers, cable manufacturers, furniture manufacturers, chain manufacturers, lead window-frame manufacturers, makers of needles and fish hooks, spade and shovel works, toffee and sweetmeat manufacturers.

It will be noted from this list that, contrary to a quite prevalent idea, industrial enterprises are not confined to town and urban areas; in fact, in carrying out electrical development in rural districts an interesting feature has been this discovery of load from industries, the existence of which had been but very little appreciated previously. The advent of electricity supplies to these enterprises in rural parts, together with the great advances made in transport, has, undoubtedly, checked what was a tendency some years ago for such industries to gravitate into the industrial centres. Further, it is

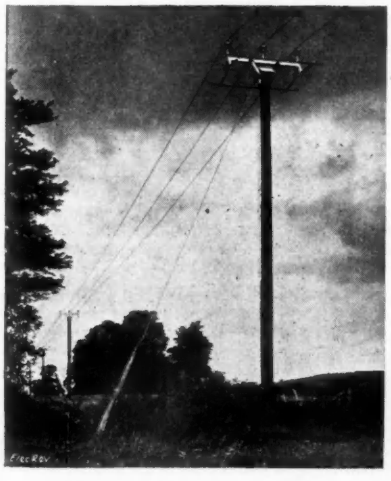


Fig. 3.—Light Angle Pole.

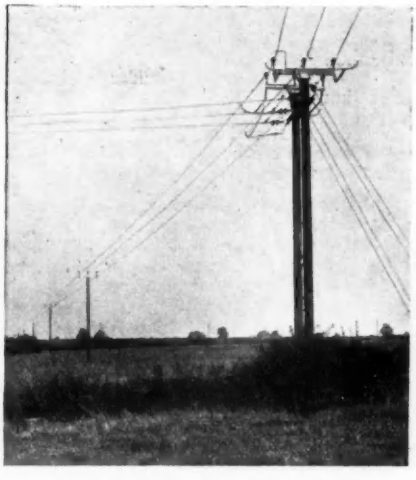


Fig. 4.—Tee Pole.

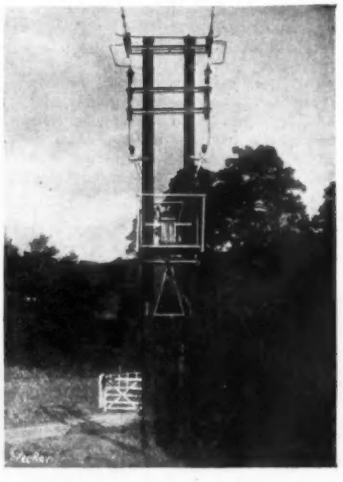


Fig. 5.—11,000/230-volt Sub-station.

found that new industrial enterprises are now being established in rural localities where, no doubt, sometime ago the sites would not have been considered at all suitable.

Of the industries referred to, several will be noted as being of a character that, if good transport and a cheap supply of electrical energy are available, is undoubtedly more suitable for development in rural localities than in the towns. Viewed locally or nationally, every reasonable facility should be given to the fostering of such industries. If electricity supply undertakings are enabled to erect their power lines, supplies of electrical energy can be made available to a far greater extent, and at lower prices, than if, due to unnecessary obstacles being put in the way, increased capital cost has to be contemplated, caused by unnecessary detours in the route, or the insertion of underground sections of cable. Additional expense such as this would, undoubtedly, limit very seriously the good work.

Many of the organisations who are opposing overhead distribution of electrical energy, and feeling that they are doing a great service in taking up an attitude on wayleaves and kindred matters which one may certainly consider the opposite to helpful, should contemplate more fully the great advantages of the wide distribution of electrical energy, and no doubt much of their harsh criticism of the electric supply industry in its endeavour to carry on this great national service would be somewhat tempered.

TABLE I.

	Supply Commenced April, 1925.		
	Dec., 1925.	Dec., 1927.	Dec., 1929.
Population	... 900	1,050	1,800
Number of consumers ...	151	202	305
Connections.			
Lighting	43.9 kW	64.23 kW	96.22 kW
Heating	2.0 kW	14.8 kW	98.30 kW
Cooking	209.0 kW	313.4 kW	468.9 kW
Power	2.5 kW	2.5 kW	16.206 kW
Total ...	257.4 kW	394.93 kW	679.626 kW
Load connected per head of population	286 watts	379 watts	377 watts
Max. demand during observation period of 10 days	46 kW	72 kW	77 kW
	Year ended March 31st,	Year ended Dec. 31st,	Year ended Dec. 31st,
Units sold.	1926.	1927.	1929.
March quarter	—	16,514	22,906
June quarter	1,710	12,167	21,061
September quarter ...	6,364	15,193	27,159
December quarter ...	12,608	17,280	29,464
March quarter	11,355	—	—
Total	32,037	61,154	100,590
Load factor	7.9%	9.7%	14.9%

Overhead-Line Construction.

Some typical examples of aerial electric power transmission and distribution lines, with notes on the past twelve months' development of their component parts and associated equipment.

THE extension of the use of overhead lines during the last three or four years for the transmission and distribution of electrical energy has been rapid, and the remarkable progress achieved in the improvement of the operation of the higher-voltage lines has overshadowed somewhat the relative problem of the lower-voltage lines, notwithstanding the activities of the Overhead Lines Association.

Service security is admittedly of paramount importance, and the following notes on work carried out during the past year indicate the realisation of the necessity for devoting attention to the subject at the beginning of systems' growth in order to avoid disappointment and costly changes at later dates. Security is attainable by the application of either preventive or protective measures; the latter is the more practicable, the present inclination being towards the allowance of ample safety factors and reliance on the system strength and layout to accept abnormal conditions and clear them without inconvenience.

Fig. 1.—Map showing Distribution of Ferranti Line-surge Absorbers.

Ferranti, Ltd.

This company claims in this connection that the surge absorber developed by it (a technical description of which was given in our issue of July 12th, 1929) is the only protective device which effectively and economically protects electrical apparatus against damage resulting from surges, whether caused by lightning, switching, or short-circuit disturbances. The absorber is connected in series with the line, usually at the entrance to a sub-station, its essential feature being that it absorbs the energy of a surge and flattens its wave-front to render it harmless without affecting the normal 50-cycle operation. Fig. 1 shows that such surge absorbers are in use in all the most important countries of the world. More than half of the total number of absorbers ordered for abroad have been supplied to that part of the world, including East India, Burma, Siam, and the East Indies, which meteorological statistics show to be the worst from the aspect of severe and frequent lightning storms. It is significant that 75 per cent. of the orders received from that area are repeat orders. Even under those world's worst conditions there is no instance on record of an absorber failing to give complete protection.

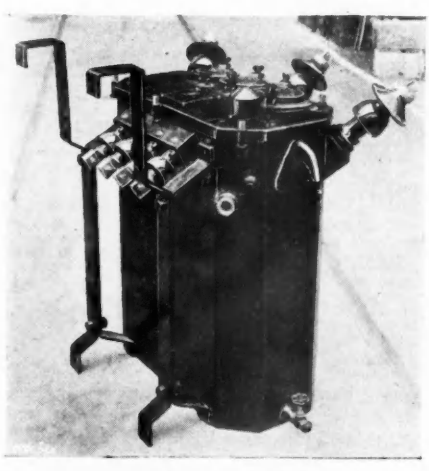


Fig. 2.—Pole Transformer, 25 kVA, 11-kV, 3 ph.

During the past twelve months there has been considerable

development in rural electrification in this country. Most English transformer manufacturers have in the past manufactured pole-type transformers for export, Messrs. Ferranti in particular having supplied some thousands to New Zealand alone. Certain modifications have been made, mainly to the terminal and mechanical arrangements, to adapt such transformers to English conditions and fig. 2 illustrates a typical 11,000-volt pole-type transformer, of 25 kVA, 3-phase.

Fig. 3.—Antrim, Northern Ireland, 33-kV Transmission Line.

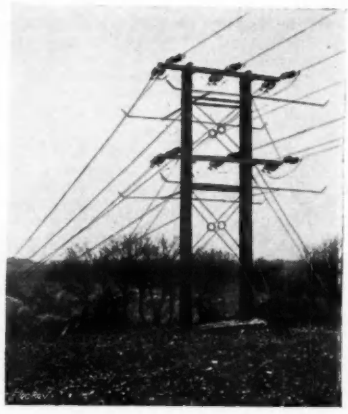
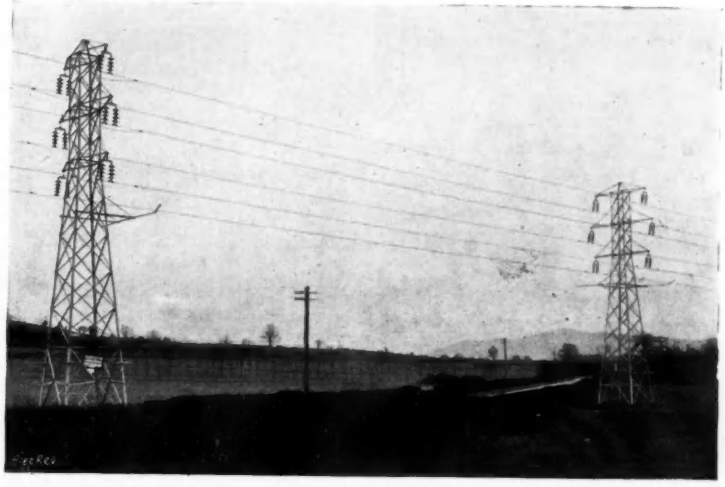


Fig. 4.—Long-span 33-kV Line in Kent.

The largest 132-kV transformer yet built for the British national grid system, and incidentally the largest transformers yet built in this country, have been delivered to the Willesden sub-station of the south-eastern section of the scheme and smaller transformers of 20,000 and 30,000 kVA at 132 kV have been put into service, fitted with gear for changing tappings under load. During the past year transformers have been under construction at the company's Hollinwood works of 80,000 kVA at 66 kV for the London Power Company's station at Battersea, and of 75,000 kVA at 132 kV for the North-West England section of the national grid scheme. These transformers easily constitute records in size (kVA rating) so far as this country is concerned, and are believed to be the largest 3-phase units in the world. In particular, the 75,000-kVA transformer is designed to operate as a self-cooled set with an output rating in accordance with B.S.S. 171 of 50,000 kVA. It is believed that, considered as self-cooled transformers of 50,000 kVA rating, these units are the largest yet made.



Strengthened with double-suspension insulators for road crossing.

Fig. 5.—Brotheridge Green-Ledbury 66-kV Line.

Richard Johnson & Nephew, Ltd.

This concern is well known as a supplier of copper conductors and non-ferrous wire and sections for electrical work of all kinds. The introduction of steel-cored aluminium conductors for general use in this country by the Central Electricity Board coincided with the enterprise of the company in jointly securing the "Crapo" galvanising patents, which seem to justify longer life claims.

It is claimed that the application of the process to overhead work has opened up the possibility of cheap lines for rural electrification and that, whilst so much depends on the situation of the lines erected, "the ten years of life" hitherto estimated for galvanised overhead lines should be considerably increased. A considerable mileage of copper-cored "Crapo"-galvanised strand wire (Collier's patent) has been erected, and the company also claims to have been the first to introduce "Caduro" cadmium-copper alloy. The "Tramway" quality gives 98 per cent. conductivity, with a tensile stress equivalent to hard bronze. The tensile stress of the "Overhead" quality is even higher, but the conductivity drops to 84 per cent.

Fig. 6.—Aluminium Distributors.

Fig. 7.—Sea Wharf Power Lines.

W. T. Henley's Telegraph Works Co., Ltd.

The company has, amongst other important contracts carried out during the past year, erected 33-000-volt overhead transmission lines for the Antrim Electric Supply Company and the Kent Electric Power Company. The Antrim line may be taken as a model, for its route was specially selected to safeguard the celebrated beauty spots of Northern Ireland; consequently from some parts of the main road adjacent to the line the towers in the valley can hardly be seen. A unique feature of the line is the terminal tower of the double-circuit route, with its sealing bells and cable connections, as shown in fig. 3, at the base of which can be seen the supports which carry the cable sealing ends. This tower is the termination of the submarine cables which connect to the outdoor sub-station at Curran Point, and the laying of these particular cables (7 lengths of 0.15 sq. in. 33-kV single-core, paper-insulated, lead-covered, non-magnetic wire-armoured) was in itself an achievement. The main contractors for the whole undertaking were Messrs. Henry Boot & Son, Ltd., and the whole scheme was planned and detailed to specifications issued by the consulting engineers, Sir Murdoch McDonald and Tasker.

The line for the Kent Electric Power Company is of double-circuit construction with an earth wire, and its special feature is four long spans of 7/.141 cadmium-copper conductor. Two spans of 1,370 and 1,529 ft., respectively, are adjacent (fig. 4) while the remaining spans of 1,318 ft. and 1,050 ft. occur separately in the run of the line. The crossing poles are of the familiar "H" type, but of special construction, having 10-ft. centres, and each leg consisting of one Rutter pole. The whole structure is assembled with two sets of ¼-in. double diagonal bracing, two sets on the front face and two on the back. The usual horizontal tie rods and distance tubes are replaced by 4-in. channels. The special crossarms adopted are double 6 in. by 3 in. channels so arranged that full benefit is taken of the strength of the section. The special features in these two lines are said to be unique.

British Insulated Cables, Ltd.

This company completed, during the summer of 1929, the overhead work for the Central Scotland portion of the national grid transmission scheme of the Central Electricity Board, which consists of approximately 234 route miles of single- and double-circuit 132-kV lines on 1,500 steel towers of the wide-base type. The conductors are steel-cored aluminium with suspension insulators. The first portions of the contract to be completed were in the Glasgow district, including the complicated double-circuit line between Yoker and Dalmarnock, which area embraces the whole of the city of Glasgow. The erection in a densely populated area of steel towers, measuring in many cases over 100 ft. in height and weighing approximately 10 tons with a spread of approximately 35 ft., was a formidable undertaking. Some of the footings for the structures needed from 15 to 20 tons of concrete for each of the four stubs. Malone anchors were used wherever possible.

A recently-completed 66-kV line is the interconnector between Brotheridge Green and Ledbury, which was erected by the B.I. Co. for the Shropshire, Worcestershire and Staffordshire Electric Power Co., Ltd. The photograph reproduced as fig. 5 shows the line strengthened at road crossing by means of double suspension insulators, an earth guard being also provided below the conductors.

The aerial cable unions referred to in our issue of November 8th, 1929, have been improved in design and are now available for all British standard sizes of copper, aluminium, and steel-cored aluminium, as also for "Copperweld" conductors. "Copperweld" earthing rods with gunmetal clamps have been introduced to meet the demand for a driven earth; no excavation is required.

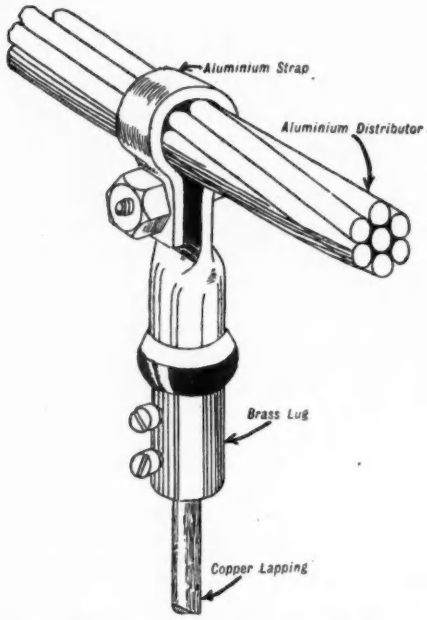


Fig. 8,—Aluminum-copper Tapping.

Pirelli-General Cable Works, Ltd.

This company has completed the grid 132-kV primary line between Bedford and Luton, which consists of approximately 27 miles of double-circuit line, the normal spans of which are 900 ft. and the straight-line steel towers between 72 and 98 ft. in height. Work is also practically at an end on the section between Peterborough and Little Barford, which route, when completed, will consist of a further 27¼ miles of single-circuit line. In addition to the South-East England scheme, the company has in the course of erection various sections of the Mid-East England primary grid line, namely, 31½ miles of single-circuit line between Grimsby and Lincoln, 11 miles of double-circuit line between Thornhill and Wakefield, and 9¼ miles of single-circuit line between Wakefield and Ferrybridge, besides which two sections of the Central England scheme are under construction near Birmingham, between Hams Hall and Nechells and between Ocker Hill and Nechells. The towers in this district are not galvanised as they are for the other schemes, but are black steel painted, with copper-bearing steel tops from the lower crossarm upwards to counteract the corrosive effects of the atmosphere of the district.

Turning to the development of rural areas, the number of overhead-line transmission and distribution schemes in hand and completed by the Pirelli concern during the last twelve months show that for the lower voltages in the majority of cases wood poles are still popular, due no doubt to their lower initial cost and ease of erection and maintenance. For such lines the company's patent pole-top bracket with a range of standard interchangeable parts for all normal road, railway, and canal crossings does away with insulated bird guards, due to the shape and arrangement of the channel section, whilst further economy is effected due to its being manufactured in one piece, thereby reducing the cost of handling and assembly. Contracts for rural 11,000-V transmission are in hand, or have been completed, in the Isle of Wight, Cumberland, in the neighbourhood of Minehead, Macclesfield, Burton-on-Trent, and Worksop. A contract of this nature at Bridgwater involved, however, the erection of four long spans of double-circuit line, where steel towers were employed.

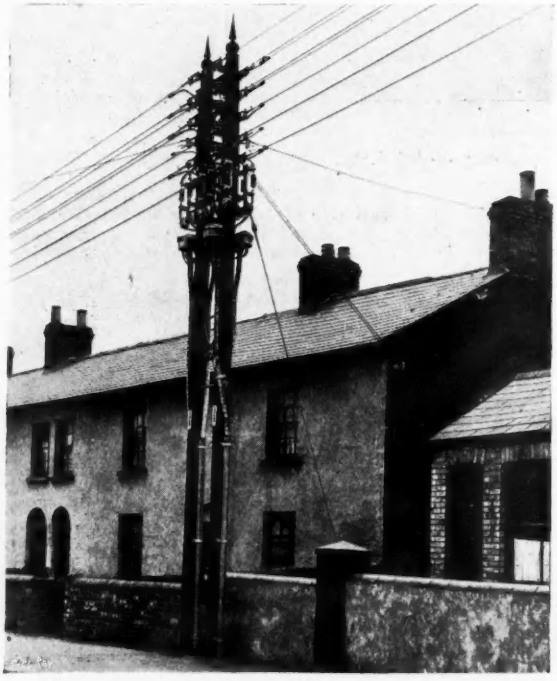


Fig. 9.—Four-way Dividing Pole.

British Aluminium Co., Ltd.

The company draws attention to the fact that while steel-cored aluminium is now recognised throughout the world as one of the most economical conductors for high-voltage lines, it is not so well known that for low-voltage distribution lines steel-cored aluminium is equally advantageous. The same features which justify its use for long-distance transmission apply in corresponding degree to the less spectacular distribution system, and it is significant that the Bedford rural distribution scheme is being carried out with steel-cored aluminium, except certain light lines, which are of galvanised steel. The oldest aluminium conductor installation in this country, having now been in operation with perfect reliability for 30 years, is that at Northallerton, while fig. 6 illustrates a low-voltage modern installation erected this year to supply the model industrial village of Inverlochy, in Inverness. In both

Fig. 10.—Distribution and Street-lighting Poles.

these instances the conductors are plain aluminium, without a steel core, but fig. 7 shows a line along a sea pier, and there the conductors are steel-cored aluminium.

In all distribution work with aluminium an important detail is the method of making connection between the aluminium main and copper branch lines. Some little care is necessary to avoid electrolytic action, while at the same time the method used must be cheap and readily applied. Fig. 8 shows a type of connection recently put on the market by the Aluminium Co. specially designed to meet those requirements. The copper branch is gripped by set screws, or, alternatively, can be sweated into a brass lug, and the aluminium conductor is gripped by an aluminium strap. The joint between the brass lug and the aluminium strap is effected in such a way that no moisture can possibly penetrate, and an insulating ring, just at the edge of the junction, prevents circulating currents.

Macintosh Cable Co., Ltd.

This concern has been responsible for the whole of the underground cable and overhead-line distribution system of the Llantarnam Urban District Council, which scheme was drawn up by the Council's consulting engineers (Messrs. Arthur Ellis & Partners, of Cardiff). The South Wales E.P.D. Co. delivers a supply in bulk at the Council's sub-station in Hill Street at 11,000 volts, where it is transformed down to 400 and 230 volts, three-phase, four wire. The sub-station equipment consists of a five-panel 11,000-volt vertical drop-down switchboard by Messrs. Erskine Heap; for the time being two 75-kVA transformers by the Fuller Electrical Manufacturing Company, and a seven-panel ironclad low-voltage switchboard by the Metropolitan-Vickers Electrical Co. Conductors heavier than usual are used to eliminate the possibilities of heavy voltage drops at the far ends of certain routes. The district served is split up into four sections, radiating from a four-way "H"-type terminal pole (fig. 9) adjacent to the sub-station, which carries four 5-core pole-dividing boxes each fed by a 5-core 0.15 sq. in. feeder cable, together with choke coils, &c. The overhead distribution system is also sectionalised at numerous points by the use of specially-made fused pole-mounted section boxes. Public lighting is provided through the medium of Wardle pole-mounted brackets (fig. 10) fed by

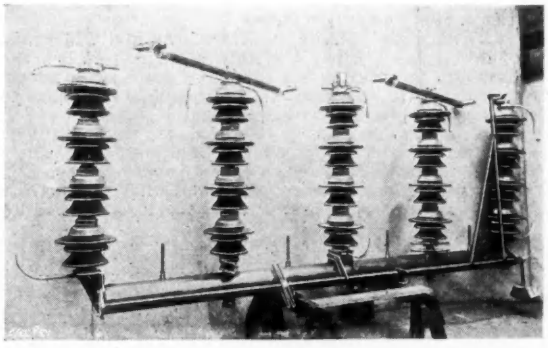


Fig. 11.—Isolating and Selector Switch, 132 kV.

a switch wire and controlled by electrically-wound time switches on the respective feeder panels at the sub-station, those fittings having been erected and connected up by the Macintosh Co. One of the most interesting features of the scheme as a whole is that prior to work commencing on the

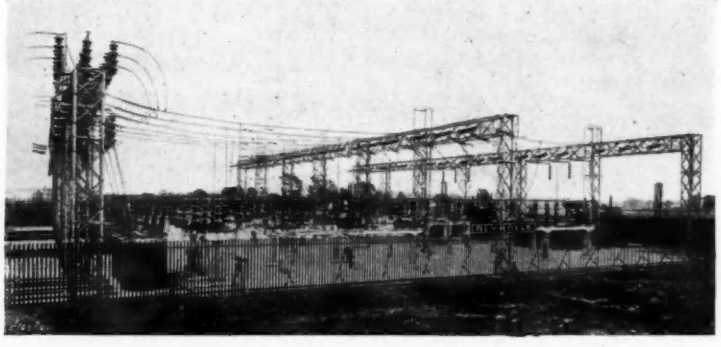


Fig. 12.—Bedford Low-type Grid Sub-station.

contract only 450 consumers were anticipated within the present area of supply, but owing to the diligence of the Council's engineer (Mr. F. E. Mills) something approaching a record has been made in that since the middle of May to date no fewer than 700 consumers' premises have been wired and serviced in approximately four months. The whole of the service work, including the erection and connecting up of such items as meter boards, cut-outs, and meters, has also been

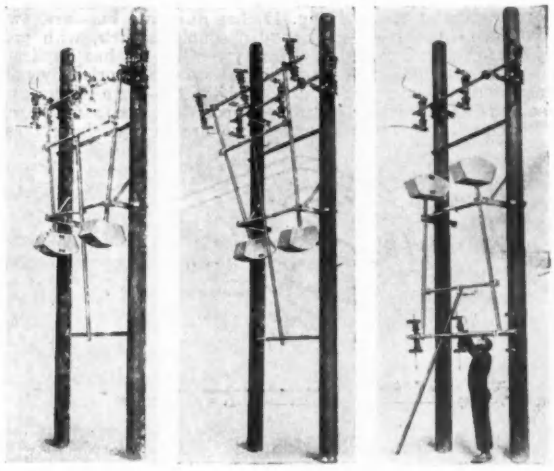


Fig. 13 a, b, c.—"Metrovick" Air-break Switch-fuse.

carried out by the Macintosh Co. at the rate of approximately 40/50 premises a week, which work necessitated very complete organisation. The Council has adopted an assisted wiring scheme, which has proved attractive in the district, payments being made through prepayment meters. The Council is an-

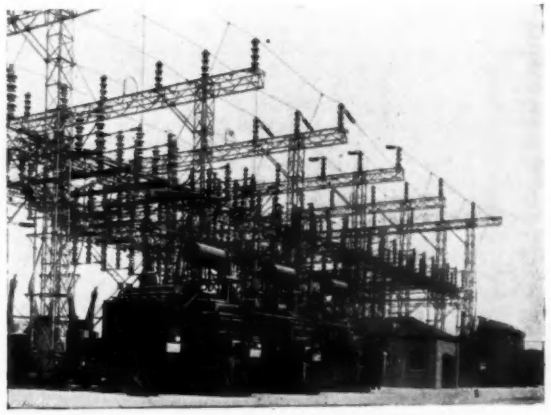


Fig. 14.—Scottish High-type Grid Sub-station.

ticipating further sanction from the Electricity Commissioners authorising it to extend the distribution system into parts of the district not already served, in which case it is anticipated that some further 400 consumers will avail themselves of supplies.

A. Reyrolle & Co., Ltd.

This company has supplied and erected five installations of Tyne-built switchgear during the year on the London-Peterborough grid line of the national transmission system. The general equipment of all those sub-stations is somewhat similar in that it comprises outdoor circuit-breakers with their complement of isolating and selector switches and the incidental interconnections (see Wright and Marshall's paper in the I.E.E. *Journal*, Vol. 67, p. 685). There are two distinct types of layout, depending upon the space available, *viz.*, the high and the low types, the former based upon the minimum ground space, and consequently disposal of the interconnections is vertical rather than horizontal. Luton and Peterborough, both of which are visible to the general public from the railway passing through the respective towns, are examples of this type. Fig. 17 showing the Luton sub-station, gives a general idea of the design and lay-out. It is of the three-switch type, there being two incoming overhead lines from the north and south, respectively, and two outdoor step-down transformers controlled by only three circuit-breakers. One of them controls each transformer and the third the junction between the two lines, a development of

the single-switch sub-station proposal characterised by the use of circuit-breakers of the same capacity at all points and the use of special by-pass circuits, which permit maintenance operations to be carried out on practically every piece of equipment without cessation of supply. Peterborough is a similar sub-station, but of the duplicate bus-bar type. The typical low-type station at Bedford (fig. 12) has duplicate bus-bars, two transformers, three feeders, and a coupler switch, with provision for a further feeder. This type of lay-out has duplicate bus-bars arranged in two parallel rows and supported by post insulators on concrete supports, and the bus-bar selectors and isolators also stand on concrete supports at the same level. The circuit and by-pass connections are carried above these

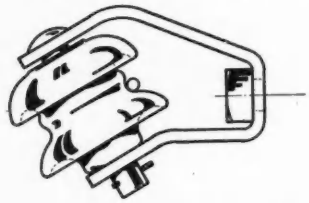


Fig. 15.—" Juno " Bracket; Left-hand Deviation.

Fig. 16.—The " Wonpeace " Insulator.

on the steel erections visible in fig. 12. The Bedford sub-station was, incidentally, the first to be made alive at 132 kV in England, having been switched in on May 23rd, 1930. The Reyrolle 132-kV oil switchgear used throughout, comprising three single-pole circuit-breakers operated by a common mechanism, has terminal bushings of the oil-filled condenser type, the housings accommodating the protective current transformers manufactured by Messrs. Reyrolle and their associated Tyneside firm, the Bushing Company, Ltd. The 132-kV isolating and selector switches illustrated in fig. 11 are of the rotating-arm type, characterised by their rigid tubular bases and by the rather unusual arrangement of contacts. The fixed contacts are of the knife-edge type and are designed to prevent the accumulation of ice and snow. The moving contacts are of the multi-spring type of flat construction, with shields to shed snow and ice. This type is operated from the ground level, and a complete system of electro-mechanical interlocks is provided to minimise dial-operation. The steel structures were supplied by the Tyneside firm of Wright, Anderson & Co., Ltd., the galvanising having been done by Messrs. Palmers.

Metropolitan-Vickers Electrical Co., Ltd.

Of the various sub-stations on the Central Scotland portion of the grid, those at Dalmarnock, Greenock, and Yoker are of the high type (fig. 14), while the remainder are of the low type, of which Paisley is now on the point of completion. The Dalmarnock 60,000-kVA bank consists of three 20,000-kVA single-phase transformers having a ratio of 20,000 to 132,000 volts; each has an external air-blast cooler with a fan and oil-circulating pump, the cooling plant being started and stopped by a temperature device on the transformer. On-load regulating gear is provided on each unit to give voltage variation of plus and minus 10 per cent. in steps of 1.43 per cent. The transformers are also fitted with oil conservators and with indicators to show the temperatures, respectively, of the oil and of the windings, the latter device having a set of contacts which operate lamp and " Klaxon " horn alarms when a predetermined temperature is reached, and also a further set of contacts which will trip the circuit breakers should the temperature increase a further 10 deg. C. The two transformers at Paisley are three-phase units, each of 15,000-kVA capacity, and are otherwise similar to the larger single-phase ones installed at Dalmarnock.

A new " Metrovick " development for use on distribution circuits at from 6,600 to 22,000 volts, is an air-break switch-fuse suitable for breaking circuit under load. It may be mounted on an ordinary H-pole with any centres from 3 to 5 ft., and, when desired, the fuses can be made accessible to an operator standing on the ground for convenient examination and re-wiring while entirely isolated from the circuit. Its capacity is 50 amperes when fitted with low-, and 100 amperes when fitted with high-rupturing capacity fuses. Fig. 13 a, b, c, show the switch-fuse, respectively, in the closed and open working positions, and as brought to ground level for examination. For all the Central Scotland section of the grid both relay protective gear and metering apparatus, representing recent developments made by the Metropolitan-Vickers Company, were adopted.

Johnson & Phillips, Ltd.

This company has recently designed new low-voltage line and service fittings which include a patented bracket that should appeal on account of its simplicity, strength, and low price. The bracket with its insulator, as used for straight-line and left-hand deviation, is shown in fig. 15. It has the following advantages: the conductor weight is taken by the porcelain, not by the binding wire, and the insulator can be used as a roller for running out conductors, thus speeding up and cheapening erection and avoiding damage to the conductor. Only one type of insulator is necessary throughout a network, and all poles are drilled alike; therefore amendments to the layout and future alterations are easily made. The bracket is reversible, so as to suit left- and right-handed deviations, and a spanner is not required for holding the pole bolthead, which locks inside the bracket. The design is much stronger than pin insulators or swan-necks, while the conductor is approximately on the same centre line as the pole bolt, thus eliminating undesirable bending stresses.

Erection costs are small, and lines using the patent bracket have been approved by the Electricity Commissioners; several thousands are in use. The cotter and brass split pin shown in fig. 15 is standard, cheaper, and saves time on site, but the bolt and nut can be supplied if preferred. A straight " D " bracket is used at straining points, such as terminals and sharp angles, and in order to enable one type of bracket to be used throughout, an alternative patented universal bracket is available at a slightly higher cost which has two pole-bolt holes; using one hole, the insulator is inclined as shown in fig. 15, while by using the other the insulator axis is vertical and thus suitable for terminals or with shackle straps for sharp angle positions.

The " Wonpeace " service insulator shown in fig. 16 consists of a brown, glazed, best-quality, high-strength porcelain suitably shedded and fitted with a galvanised coach screw for pole or wall fixing, or, alternatively, fitted with a steel stud for bracket fixing. Its advantages are that it is cheap, and no separate ironwork, screws, or bolts, &c., are required. Three or four services can be easily taken from one fitting, due to the large diameter hole, which is not possible with shackle insulators. It is not necessary to disturb the existing line fittings in order to add services, and the insulator is fixed to a pole by drilling a small hole and screwing home by hand, a tool not being necessary for this purpose. For tubular steel poles the stud pattern is used, fixed to a suitable pole strap which can be supplied with the insulator.

The tests on the insulator give the following average results for mechanical strength:—Direct pull in line with screw or stud, 1,200 lb.; lateral pull at right angles, 930 lb. As the tension of the average service wire is between 10 and 40 lb. it will be seen that the factor of safety is a very high one.

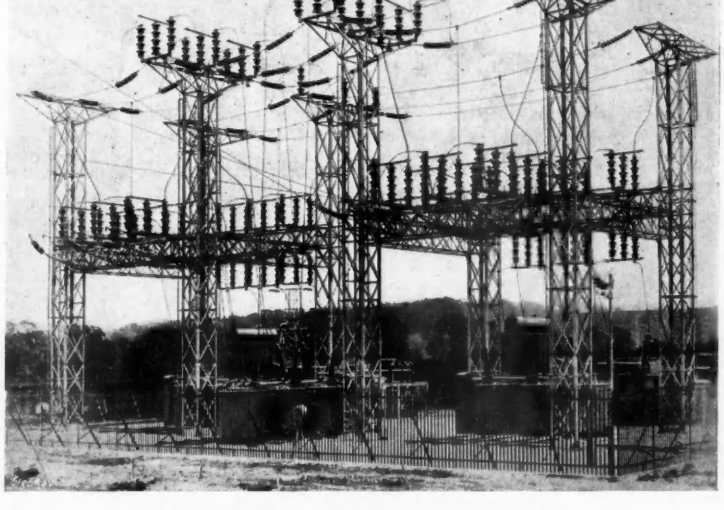


Fig. 17.—Luton High-type Grid Sub-station.

Electric Fires: Some Recent Designs.

In the following notes we present examples of the electric fires produced by the leading manufacturers. We have aimed at selecting what is new and at the same time at making the selection representative. It is hoped that the article will prove useful as a guide to contractors, retailers, and others concerned in the supply of these useful appliances to the public.

SEVERAL new "Magicoal" fires have again been produced by Berry's Electric, Ltd., and two of these are illustrated. The "Fireberry" (fig. 1) is of the open-grate type with the heating elements (3,000 W) fitted in the canopy. The ducts at the top facilitate the circulation of the warmed air. The standard finish is plated bronze, but others can be obtained. The substantial nature of this fire can be gauged from the fact that its weight is 56 lb. Fig. 2 shows the "Sunberry," which has been designed for the moderate purse. The "glowing coal" is fitted in a recess above an open fire-bar (of 1,000- or 2,000-W loading). The finish is in oxidised silver or copper.

Fig. 1.—The "Fireberry."

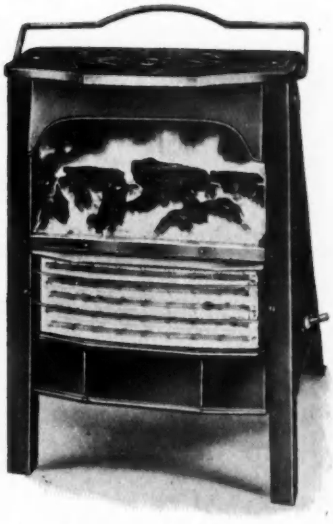


Fig. 2.—The "Sunberry."

The screen fire shown in fig. 3 is a product of the Manor Electric Oven & Fire Co. A special feature of this is the adjustability of the back legs, which permits the fire to be set at different angles. The loading of the fire is 3,000 W controlled by two switches, and the finishes available are oxidised copper or brass or old silver.

Fig. 3.—The "Manor" Screen Fire.

Fig. 4.—A Dual "Tricity" Fire.

Among the fires produced by the British Electric Transformer Co., Ltd., is the combined "coal" and reflector fire depicted in fig. 4. This is produced in various finishes and is equipped with two 1,250-W elements controlled by kick switches. Another new "Tricity" model of a simpler character is a cast-iron portable fire, which is given a vitreous-enamel finish and is made in three sizes, 1,000 W, 2,000 W and 3,000 W.

The "Princess" coal fire (fig. 10), made by Messrs. Belling & Co., is a handsome production in which two 1,000-W fire-bars are mounted in the front and a curved hooded reflector is fitted. The "Interior" fire (fig. 5) is another "Belling" design intended for fitting into an existing grate opening; it is 18 in. wide and 25 in. high and has a 2,000-W loading. Both of these fires are available in antique brass, or oxidised copper or silver.

Novelty of form is apparent in the "Heatrae Crusader" fire (Electric Fires, Ltd.) shown in fig. 6. The hammered copper reflector is of unusual shape and the 2,000-W loading is distributed between three square panels. The framework is of stainless steel. The illumination of the imitation coal is independently controlled. Fig. 7 shows another "Heatrae" model — the "Royal"—which is also an imitation coal fire designed to fit in an existing fireplace with a suitable surround. The fire is loaded to 2,000 or 3,000 W and is given an antique brass or oxidised copper finish.

The "Quead" fire illustrated in fig. 8 is one of the range supplied by Messrs. William Geipel & Co., Ltd., and has a loading of 3,000 or 3,750 W. It is procurable in satin or ebonite black or olive, brown, grey and white vitreous enamel.

The "Angelus" fires produced for the season by Messrs. Charles Joyner & Co., include the original models illustrated in figs. 9 and 11. The first of these is a dog-grate containing an imitation coal fire. The basket and dogs are of armour-bright finish and the backplate is of cast iron. The design is a direct reproduction of an Early English fire. The fire has a load-

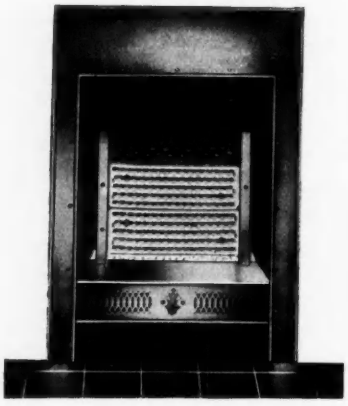


Fig. 5.—The Belling " Interior " Fire.

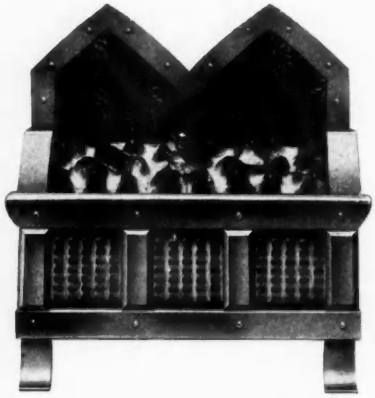


Fig. 6.—The " Crusader " Fire.

Fig. 7.—The " Royal " Fire.

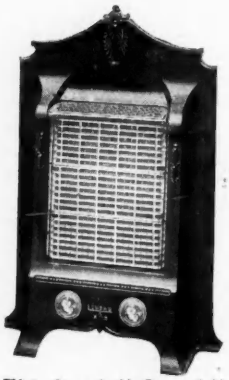


Fig. 8.—A " Quead " Fire.

Fig. 9.—An " Angelus " Period Design.

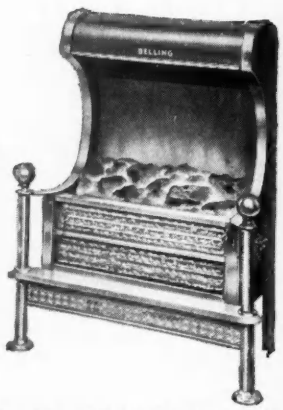


Fig. 10.—The " Princess " Fire.

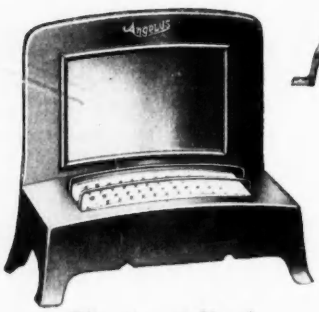


Fig. 11.—A Simple " Angelus " Fire.

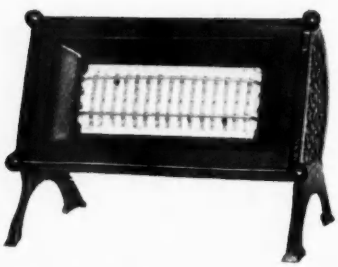


Fig. 12.—The " Imp " Fire.

Fig. 13.—An " Efescoal " Design.

Fig. 14.—The " Lichfield."

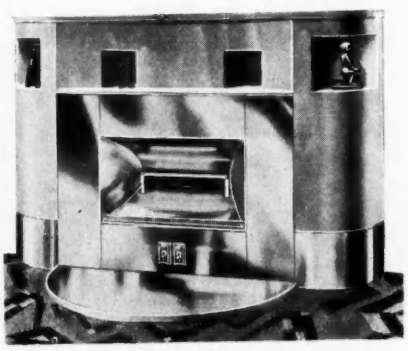


Fig. 15.—A " Ferranti " Fire.

Fig. 16.—An " Elect " Fire.

Fig. 17.—A " Magnet " Panel Fire.

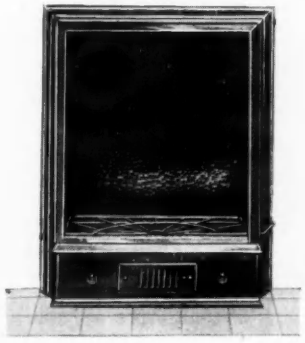


Fig. 18.—Another G.E.C. Design.

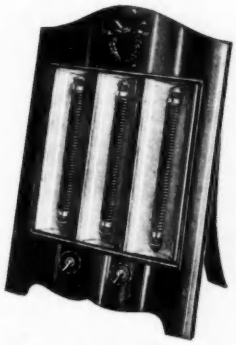


Fig. 19.—A New " Revo " Fire.

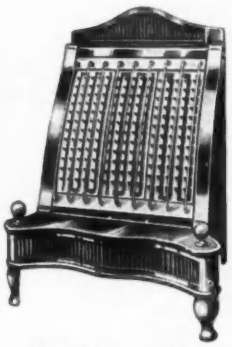


Fig. 20.—Another " Revo " Model.

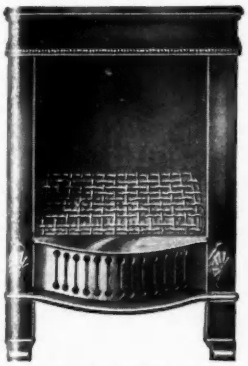


Fig. 21.—The " Raymond " Fire.

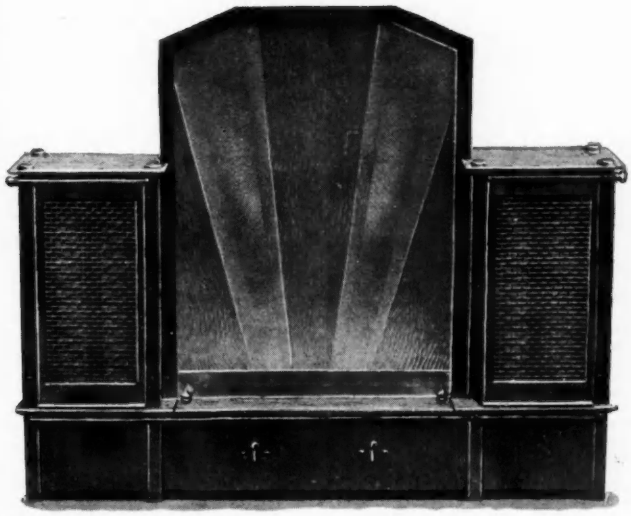


Fig. 22.—A " Rippleray " Fire.

Fig. 23.—A Box-type Fire.

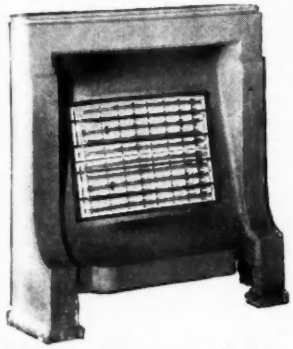


Fig. 24.—The " Isis " Fire.

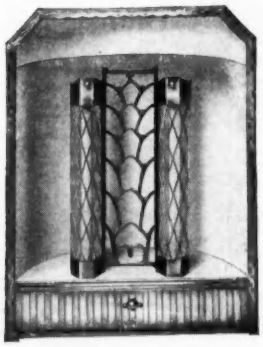


Fig. 25.—An " Xcel " Reflector Fire.

Fig. 26.—The " Furniculus " Fire.

Fig. 27.—An " Ediswan " " Coal " Fire.

Fig. 28.—The " Arora " Reflector Fire.

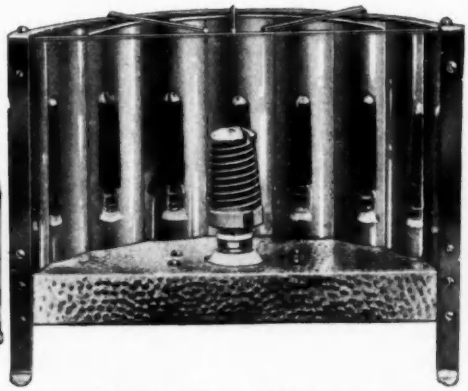


Fig. 29.—The " Welcome."

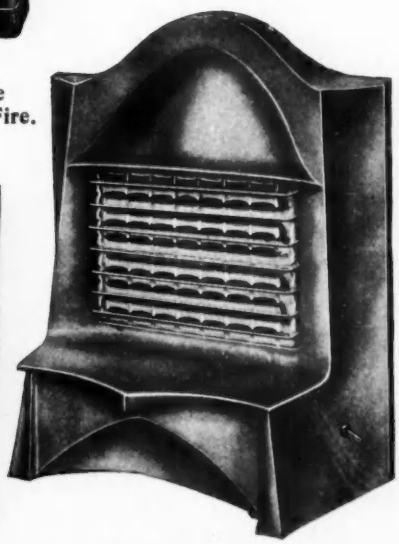


Fig. 30.—The " Regal " Fire.

ing of 2.000 W, weighs 136 lb., and measures about 33 in. high and 35 in. wide. Fig. 11 shows a fire of a very different character. This is extremely simple in design, consisting of a 750-W fire-bar mounted horizontally at the foot of a stainless-steel reflector. The frame has a Florentine bronze finish.

A handy little appliance for occasional use is the "Imp" type (fig. 12) supplied by Messrs. Falk, Stadelmann & Co., Ltd. The 650-W bar is set in a reflector mounting and the whole is in a cast frame. One of the "Efescoal" fires is illustrated in fig. 13. This is a 2,000-W model of substantial construction and is provided with a useful hob plate.

Among the fires included in the new season's catalogue of Carron Company is the handsome "Lichfield"

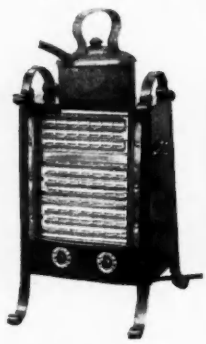


Fig. 31.—The "Roma" Fire.

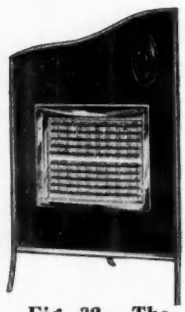


Fig. 32.—The "Chippendale" Model.

Fig. 33.—The "Townsend" Fire.

design illustrated in fig. 14. It is about 2 ft. in height, the hammered reflector being of polished copper or chromium plated. At the foot of the reflector a convex fire-bar (1,000 W) is mounted, and over it is a strong wire trivet. Black-enamel, electro-bronze, oxidised silver, and chromium-plate finishes are provided. Another new Carron design is the "Argus," which is available in two sizes—2,000 and 3,000 W. Both sizes are produced in no fewer than sixteen shades of porcelain enamel—a choice wide enough to suit all tastes.

Messrs. Ferranti, Ltd., are the makers of the fire illustrated in fig. 15. It is one of their larger models set in a beautiful modern environment. A new design

Fig. 34.—A "Meracol" Model.

Fig. 35.—A Small "Komet" Fire.

Fig. 36.—The "Phœnix."

which the company has produced is a small-scale reproduction of the larger model. It has a chromium-plated reflector. One original feature is a 10-in. rod of small diameter in which the wire is embedded in a special cement. Simple spring clip contacts keep the rod in the focal centre of the reflector. The fire has a loading of 750 W; it is 15 in. high and 19 in. wide.

Among the "Elect" fires supplied by the London Electric Firm is a well-grate imitation coal fire (fig. 16). This has a hammered copper reflector and ornamental front legs. Several finishes are available, including oxidised silver, brass or copper, black matt and satin brass.

Fig. 17 depicts the middle size of three new cast-iron panel fires introduced by the General Electric Co., Ltd. It is a 2,000-W model, the others having loadings of 1,000 W and 3,000 W. The fires are of very sturdy construction and are provided with heat-insulated drop-down handles. The finishes available are black stoved enamel and multi-coloured vitreous enamel. Another G.E.C. design is shown in fig. 18. This is arranged to fit into an existing grate opening. It is finished in real bronze colour and has a hammered-copper reflector. The elements are provided with two controlling switches. The fire is 26 in. high and 20 in. wide.

We next illustrate two of the new models evolved by the Revo Electric Co., Ltd. The first (fig. 19) consists of three "Revo Radiabar" elements in vertical chromium-plated trough reflectors, the whole being mounted in an ornamented cast-iron frame. The fire is available in antique copper and oxidised silver. The other (fig. 20) is a 3,000-W fire in which the bars are so arranged as to give a wide distribution of heat and are controlled by two switches. It has a cast-iron frame, finished in armour bright or oxidised silver, and a bottom and back of sheet metal.

The Edison Swan Electric Co., Ltd., has taken over the sale of "Cosmos" fires, and they now bear the name "Ediswan." One of these fires is illustrated in fig. 21; it is the "Raymond" model—one of a series of about ten designs. This is arranged with 2,000- or 3,000-W loading, and the finishes available are oxidised brass, copper, or silver and chromium-plated. The elements, as in most of the "Ediswan" fires, are of the plug-in type. A Tudor imitation coal fire supplied by the company is shown in fig. 27. This, again, is fitted with plug-in elements and can be obtained with 2,000-W or 3,000-W loading. The fire is finished in oxidised copper or silver and chromium.

Messrs. Best & Lloyd, Ltd., can claim novelty for the fire depicted in fig. 22. It comprises a "Ripple-ray" glass screen flanked by 750-W fire-bars in pairs protected by grilles. The glass is flame tinted and rippled, and by means of reflected light passing through bubbling water a flame-like movement is produced on the screen. The fire is produced in brass and aluminium, finished in polished aluminium, nickel-plated, and stippled; it is 26 in. in height and 31 in. wide.

A recent production of Super-Electric Heaters (1929), Ltd., is a box-type fire (fig. 23). This has three fire bars, two of which are mounted in the front of the fire; the third is fitted horizontally, being protected by a wire guard upon which light utensils can be placed. The reflector is of hammered copper and the frame has an oxidised-copper finish. The total loading is 1,870 W.

Premier Electric Heaters, Ltd., have introduced

three new ranges of fires—the "Clyde," "Isis," and "Medway." These are produced in three sizes—1,000, 2,000, and 3,000 W and two standard finishes—eggshell, gloss black, and majolica vitreous enamel. The "Premier" double-radius fire-bar, which gives a wide distribution of heat, is employed in all models. The 2,000-W "Isis" fire is shown in fig. 24. The popular "Berwick" fire is now produced in an antique copper finish produced by a special electro-depositing process.

The "Furniculus" fire shown in fig. 26 is provided by the A.E.G. Electric Co., Ltd. It comprises four 500-W elements, switched in pairs, mounted in horizontal nickel-plated trough reflectors. The frame is of a simple character with a blue patina finish. A smaller model (1,000 W) of similar design is also available.

The "Reflector" fire (fig. 28) and the "Welcome" fire (fig. 29) are products of the Arora Co. The first is of simple but robust construction; the elements (1,000 or 2,000 W) are fitted horizontally and are protected by a strong wire guard upon which utensils may be placed. The two finishes available are old gold and bronze, the reflector being of hammered brass or copper, respectively. The "Welcome" fire is of a somewhat novel character. It is semi-circular in plan; the spiral element (500 W) is mounted vertically in the centre, and it is backed by a corrugated nickel-plated reflector which gives a manifold reflection.

The new fires introduced by Messrs. Chesterton, Jones & Co., Ltd., include the "Regal" model (fig. 30), a cast-iron fire finished in any one of a number of vitreous enamels or in bright black. It has a loading of 2,000 W. The "Coronet" fire, made by the same company, is an artistically curved model, having cast-iron sides finished in antique copper and a hammered copper reflector. This, too, is a 2,000-W fire.

In their new "Roma" fire (fig. 31), Messrs. H. W. Sullivan, Ltd., have again employed the movable top element which can be turned into a horizontal position for boiling purposes. There are also one, or two, other bars all of 750-W loading. Four finishes are available.

The "Dolphin" fires produced by Domestic Electrification, Ltd., are handsome and distinctive. The "Townsend" model, seen in fig. 33, is intended for an existing fireplace. The vertically-mounted elements (2,000 or 3,000 W) are surrounded by a chromium-plated reflector. The fender top is also chromium plated while the body is finished in any one of five types.

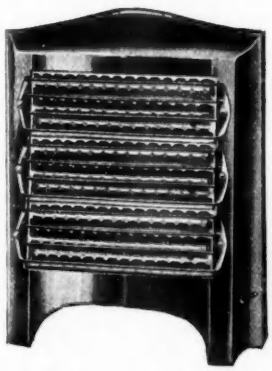


Fig. 37.—A "Jackson" Cast Fire.

Fig. 38.—The "Majestic" Fire.

Fig. 32 shows a very different pattern made by the same company. This, the "Chippendale," is a screen-type fire, with a 2,000-W loading, which is also available in five finishes.

Fig. 34 is the "Utility" model of the "Meracol" series produced by the Thermo Path Co., Ltd. This is fitted with elements with 1,500- or 2,500-W loading, consisting of double-helical wound bars which are easily detached. The framework is of steel finished in crystalline black and the reflector is of untarnishable aluminium alloy.

New products of Electric Heating & Hardware, Ltd., include its No. 851 direct-heat fire (fig. 35), which is fitted with an entirely new element with a "diamond facet" reflecting surface behind the resistance coil which gives an excellent throw of heat. This model is 12½ in. high, 13¾ in. wide, and 5 in. deep, finished in light green, French grey, and light blue vitreous enamel. It is of robust construction, and special monel fittings on the element connecting the resistance wire to rockbestos internal wiring keep the connections cool. The whole of the insulation is of porcelain.

Fig. 39.—A "Cosyglo" Fire.

Fig. 40.—A "Hotpoint-Falco" Fire.

A fire of unusual design is the "Phœnix" model (fig. 36), made by Messrs. Veritys, Ltd. This has a boldly-modelled cast-iron body finished in black stove enamel. Two 1,000-W fire bars are fitted. For smaller applications there is a one-bar model of this fire, the height being corespondingly reduced. The "Industrial" fire supplied by the company has a perforated metal enclosing front which prevents the elements being touched. This should find many applications.

The Jackson Electric Stove Co., Ltd., has brought out a new series of cast fires, in one-, two- and three-bar patterns, a 1,000-W bar being employed. The fires are of cast iron and are obtainable in green, pink, brown, primrose and black vitreous enamel or in white. The three-bar model is illustrated in fig. 37.

The Credenda Conduits Co., Ltd., has put a number of new models of electric fires on the market for the current season. One of these is the "Majestic" fire which is illustrated in fig. 38. This is of handsome appearance and is simply ornamented. Four fire-bars are fitted, the bottom one being set at an angle to throw its heat upwards. Three control switches are provided. This year the company is able to supply fires in a greater variety of finishes than in previous years.

One of the new "Xcel" designs which are being marketed by Siemens Electric Lamps & Supplies, Ltd., is the "Cosyglo" model, which is seen in fig. 39. This is a combined "coal" and reflector fire with moving flame and smoke effect. The 2,000-W element is fitted in a hammered-copper reflector in the base of the fire. A bronze finish is applied to the frame. Fig. 25 illustrates another "Xcel" fire of original, modernist design. A semi-cylindrical polished-aluminium reflector is fitted in a solid brass frame with an oxidised silver finish. Each of the two 1,500-W elements is protected by an expanded metal guard, and between them is an ornamental grille.

The "Cosy" fire shown in fig. 40 is a "Hotpoint-Falco" model marketed by the Hotpoint Electric Appliance Co., Ltd. It is of sheet-metal construction and provided with two or three 1,000-W elements. The trivet can be fitted below the elements, as shown, or above them. Standard black or electro bronze, copper or brass finishes are available.

Electric Lighting Fittings.

New Designs show Originality and Modernity.

There are indications of a definite movement on the part of the public towards "modernist" designs of electric lighting fittings. As in the case of the electric cooker, the gas precedent was originally followed and a considerable effort was necessary to break away from the trammels thus imposed. Electricity is so much more adaptable than gas that it requires an absolutely new technique; in the past four or five years that technique has been developed and much originality has been manifested by designers. On this account most of the fittings which we illustrate are strictly modern, although developments of the "classic" models are also represented.

Fig. 1.—A Four-tiered Pendant.

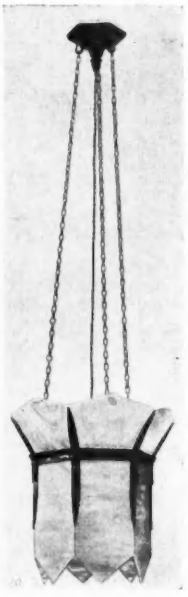


Fig. 2.—A Panelled Pendant Fitting.

A BEAUTIFUL "Neolux" pendant fitting produced by Messrs. Louis Dernier & Hamlyn, Ltd., is shown in fig. 1. It consists of four octagonal pieces of glass held by four ornamental metal brackets fixed to a handsome gallery. The glass is obtainable in six colours—"sunlight," "moonlight," "gloaming," "citron," "mulberry," and pink.

A table standard of a very modern fashion by Messrs. Best & Lloyd, Ltd., appears in fig. 3. It is produced in iron and brass with a parchment, aluminium-sprayed shade. Its overall height is about 15 in.

Another table standard of a modern character is illustrated in fig. 9. The panels can be provided in a number of types of glass. Fig. 2 shows a pendant fitting with opalescent coloured glass panels which can be supplied in various tints. The fittings are made of fine cast brass. Both of these are products of Messrs. William McGeoch & Co., Ltd.

Many exquisite designs are on view at the showrooms of Messrs. Osler & Faraday, Ltd., including the single-light "Pastelite" table lamp illustrated in fig. 6. This comprises golden-amber cut-glass panels in an ormolu finished metal frame. Another fitting by the same company is a two-light sconce of novel shape (fig. 4) in lilac and rose quartz cut "Pastelite" glass. The "Pastelite" fittings comprise 72 different shapes, each of which can be made in two or three dozen colours, providing an almost bewildering variety.

The next two examples have been received from the Sun Electrical Co., Ltd. One (fig. 7) is a panelled pendant with unobtrusive metal fittings and chain; obscured glass with a ripple finish is employed. The other (fig. 5) is a ceiling fitting of an original character consisting of four glass cylinders, in which tubular lamps are fitted, terminating in oxidised-brass cups. The fitting is 18 in. square overall and has a projection of 8 in.

Three new fittings have been added to the "Duplexalite" range supplied by Messrs. L. G. Hawkins & Co., Ltd. One of these is depicted in fig. 8, and as will be seen the fitting is constructed of spun metal tiers of attractive contour. These are virtually indirect units, but space is provided between the tiers so that the single lamp used illuminates the exterior of the fitting providing a "live" effect. A matt aluminium reflector inside the fitting gives a wide diffusion. The other models are of a more ornate character.

The "Pagoda" fitting illustrated in fig. 10 is one of an entirely new range introduced by Holophane, Ltd. These consist of prismatic panels made up in various forms, the one shown having six of such panels with a circular enclosing panel at the bottom. It measures 19 in. in depth and the overall width is 14 in. Single panels for wall mounting or for arranging in continuous lengths for cornice lighting, &c., are also being supplied, enabling the illumination of a large apartment to be carried out in a uniform manner.

Among the pioneers of modern electric lighting are Messrs. Troughton & Young, Ltd., who, as electrical contractors, have the task of educating the customer in the modern idea of illumination. Two examples of fittings provided by them are illustrated. The first (fig. 11) is a ceiling fitting of Parisian origin and it comprises a silver-plated conical ceiling plate and two

Fig. 3.—A Modern Table Standard.

cylinders of frosted glass cut obliquely. A single lamp in the centre cylinder gives good illumination and makes an interesting play of light through the two thicknesses of glass. Fig. 12 is a wall bracket intended for fixing over a mirror. The three suspended glass panels screen

Fig. 4.—A Two-lamp Sconce.

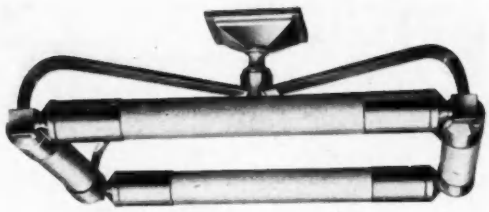


Fig. 5.—A Four-lamp Tubular Fitting.

Fig. 6.—A Handsome Table Lamp.

Fig. 7.—A Panelled Pendant.

Fig. 8.—A New " Duplexalite " Unit.

Fig. 9.—A McGeoch Table Standard.

Fig. 10.—A Holophane " Pagoda " Fitting.

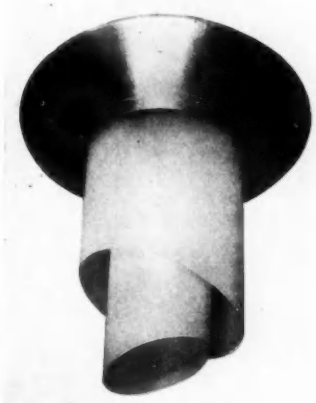


Fig. 11.—A Cylindrical Ceiling Fitting.

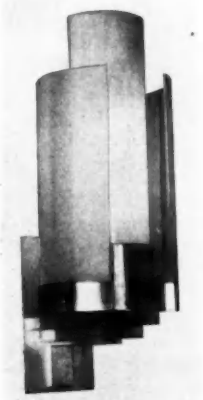


Fig. 12.—A Parallel Wall Bracket.

Fig. 13.—New " Siemens " Design.

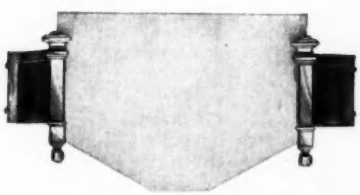


Fig. 14.—A Single-panel Bracket.

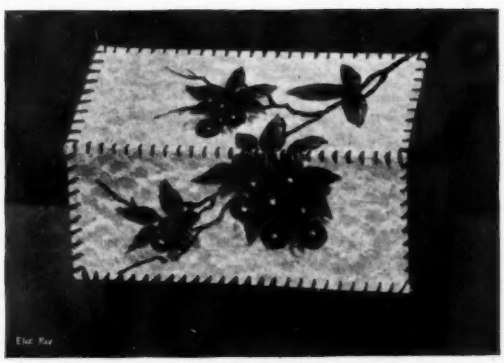


Fig. 15.—An Improved Bed Light.

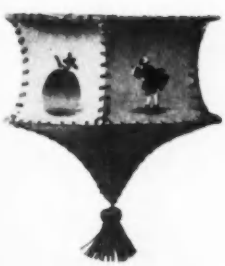


Fig. 16.—A Parchment Shade.

the glare of the lamp but allow for good illumination of the face.

Among the new designs of Siemens Electric Lamps and Supplies, Ltd., are a number of decorative pendants, one of which is illustrated in fig. 13. This is a delicately-tinted crystal etched-glass unit with a depth and width of about 12 in. The suspension chains can be supplied in polished brass, toned bronze, or oxidised copper or silver.

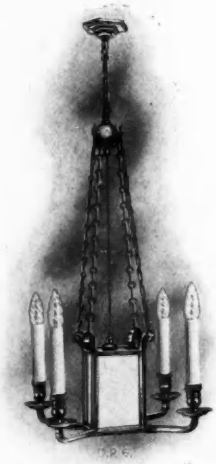


Fig. 17.—A Five-lamp Pendant.

Fig. 18.—A " Hailware " Fitting.

Messrs. Frederick Thomas & Co., Ltd., are the manufacturers of the wall bracket shown in fig. 14. This comprises a cast brass frame in which is fitted a panel of obscured " pin-head " glass and a polished aluminium back. The bracket is finished in brass, copper, or silver and its width is about 12 in. Another wall fitting by the same company is seen in fig. 19. This is a three-panel bracket of black and white alabaster. Its width is similar to that of the other bracket.

Fig. 19.—An Alabaster Bracket.

Messrs. F. Parks, Ltd., have improved their comprehensive range of bed-light shades, one of which is illustrated in fig. 15. These are now provided with swing hooks and back rail, affording an air space between the bed and shade, thus averting the scorching or discolouring of the bed. The shades are fitted with lampholder, " torpedo " switch and adaptor.

Electric Art Shades (1928), Ltd., produces a wide range of silk and parchment shades as well as some beautiful examples of table lamps in Royal Stanley Jacobean ware. One of the company's shades is illustrated in fig. 16, which shows a parchment pendant " bowl" with an eighteenth century design.

Messrs. Hailwood & Ackroyd, Ltd., are the producers of the five-light pendant shown in fig. 17. The fitting is suspended by four chains to a metal ball and then by a single chain to a hexagonal ceiling plate. " Hailware " glass is used effectively, and the design is simple and very decorative. " Hailware " glass is also employed in the simple wall light illustrated in fig. 18. The oval centre panel bears a figure moulded in relief.

The Wholesale Fittings Co., Ltd., has produced for the season a number of new designs in " Supastone " and " Altolite " glassware; the latter includes many new colour schemes. Fig. 20 depicts a modern type tiered wall bracket, which is supplied by the company in deeply etched crystal glass.

The " Masterpiece " shade, which is depicted in fig. 21, is the latest product of the Excelsior Shade Manufacturing Co. It is of imitation parchment decorated with a simple bright design. The principal feature of the shade is its strength. It is octagonal and at each angle and at the top and bottom it is very rigidly braced.

Lighting Trades, Ltd., has produced many new designs for the current season, including " Moonmist " brackets and pendants. " Moonmist " glassware has a satin, pearl-like finish giving a beautifully-diffused light. It is produced in panels which, in turn, are made up into a variety of forms. One novelty which the company is supplying is the table standard shown in fig. 22, representing a balloon seller mounted on a Jacobean oak plinth. An old-gold silk shade is fitted.

Fig. 23 illustrates three "Kandem" fittings supplied by Korting & Mathiesen Electrical, Ltd. The top fitting is a double cylindrical design in which the lamp is suspended between two cylinders of opalescent glass. The fitting is suitable for lamps up to 200 watts. The centre illustration represents a ceiling fitting mainly intended for use in entrance halls, corridors, rooms with low ceilings, &c. The third fitting is of the dust and moisture-proof type. The one-piece globe embodies two different kinds of glassware—the upper part being dense opal and the lower part opalescent.

Fig. 20.—A Tiered Wall Bracket.

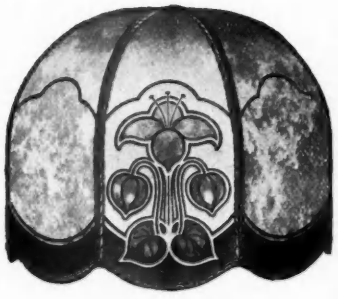


Fig. 21.—The " Masterpiece " Shade.

Fig. 22.—A Novel Table Standard.

Fig. 23.—Three " Kandem " Fittings.

Some Domestic Appliances.

A Few of the Many Ways in which Electricity is Employed.

IN the majority of cases lighting is the means of introducing electricity into the home. Then, before the larger applications—fires, cookers, and water-heaters—are embarked upon there is usually an interim period in which a number of small appliances are tried and become indispensable. The iron is usually the first device, and it may be followed by the toaster, the vacuum cleaner, or the kettle. The advantages of electric cooking are tested on a small scale by the use of the boiling ring and the grill, and the bowl fire is the first essay in electric heating. The small appliance, then, is of some importance to the industry and the public, both because of its intrinsic merits and its way of serving as an introduction of more business. In the following article we have selected a few of the appliances of this kind as an indication of what is available.

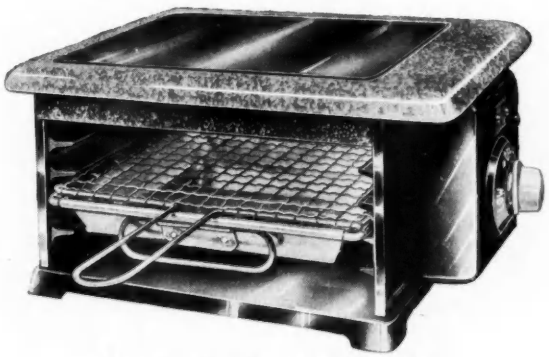


Fig. 1.—A " Revo " Grill-boiler.

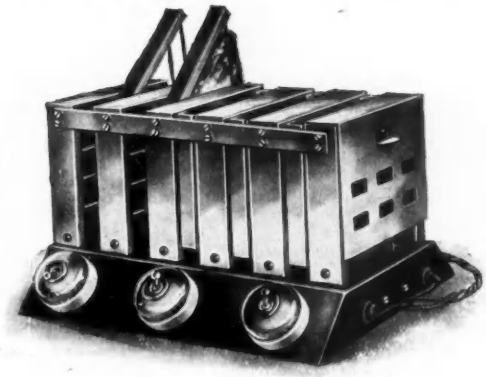


Fig. 2.—A Multiple Toaster.

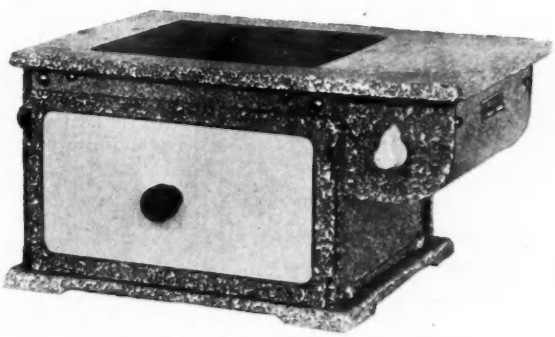


Fig. 3.—A New Breakfast Cooker.

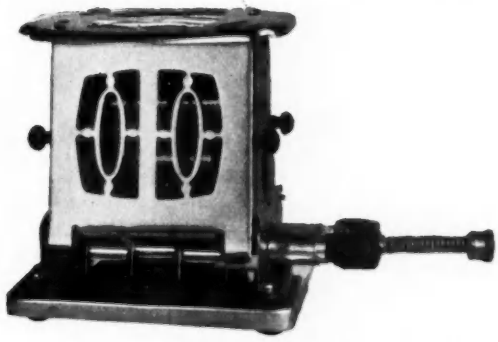


Fig. 4.—A New G.E.C. Toaster.

Fig. 5.—The " Revo " Automatic Kettle.

Fig. 6.—The Bulpitt Whistling Kettle.

Fig. 7.—The " Hotpoint " Automatic Kettle.

In fig. 1 we illustrate a very useful table cooker produced by the Revo Electric Co., Ltd. It is a combined grill and boiling plate with a single element serving the double purpose. It has a cast-iron frame; the hob is vitreous enamelled; and a grill pan and grid of ample dimensions are provided. The element is controlled by a three-heat switch. Another recent " Revo " product is an automatic kettle (fig. 5). In this there is a switching-off arrangement which operates when the kettle boils dry. This is re-set by simply pressing a button on the

side of the base, there being nothing to fit or replace.

The next illustration (fig. 2) is an improved multiple toaster made by Electrical Utilities, Ltd. This has a cast-iron base upon which the elements are rigidly mounted. The toast-holders are also of cast iron and the two straps across each of these are made of "Silveroid," a non-corrodible nickel alloy. The resistance elements are of a non-sagging character having internal mica supporting strips. The refractories are mounted between sets of sherardised metal runners.

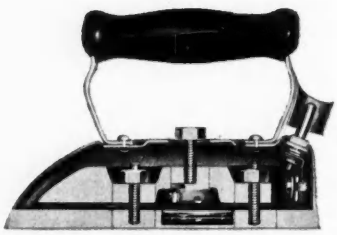


Fig. 8.—An Automatic Iron.

A portable reflector plate is provided for insertion between the elements to reduce the number of toasting elements to be used at a time.

Messrs. Falk, Stadelmann & Co., Ltd., have introduced a new electric breakfast cooker (fig. 3) with a dual-purpose top element. When this is required for boiling only, the white vitreous-enamelled deflecting plate is placed underneath so as to throw the whole of the heat on to the bottom of the utensil. If, however, the apparatus is to be used for boiling, frying, grilling, or toasting, the plate is removed. Two finishes are available, *viz.*, with black body and mottled vitreous grey enamelled top, and all vitreous grey enamel.

A new boiling plate also introduced by the company has a very powerful element which should recommend it for many industrial purposes, as the frame is cast and can sustain considerable weight.

A coffee percolator of neat design, made by the General Electric Co., Ltd., is shown in fig. 10. This is made in 1½- and 2½-pint sizes in polished aluminium or nickel-plated copper. The interior is removable for cleaning and the appliance is protected from burning-

Fig. 10.—A G.E.C. Percolator.

out by a fusible plug. Fig. 4 illustrates a new reversible toaster—also by the G.E.C. The two bread racks when turned outwards quickly reverse the bread without the necessity of touching it with the fingers. The flat perforated top is of sufficient size to accommodate a plate.

A whistling device operated by the steam from the boiling water may be fitted to a kettle instead of a thermostatic cut-out. A kettle thus equipped is shown in fig. 6. It is filled through the spout into which the whistle is plugged. The appliance is made by Messrs. Bulpitt & Sons, Ltd., and, like all their water-heating equipment, is fitted with an immersion-type heater, which ensures maximum efficiency. The kettle is of polished copper and has a loading of 1,000 W and a capacity of 3 pints.

Several exclusive features characterise the "Hotpoint" automatic kettle, depicted in fig. 7 (Hotpoint Electric Appliance Co., Ltd.). In the first place, the element is of a special type known as the "Calrod" in

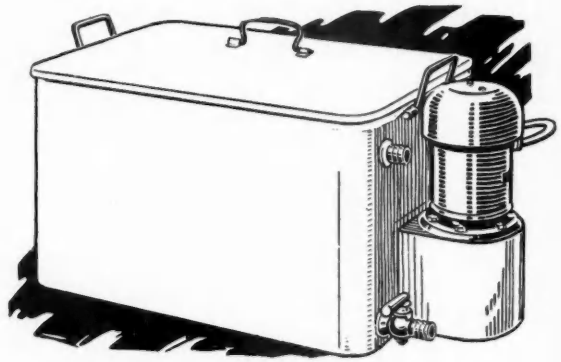


Fig. 9.—The "Hera" Clothes-washer.

which the resistance wire is encased in magnesium oxide surrounded by protective metal casing. In the circuit is a thermostatic device which operates immediately the kettle is boiled dry and is re-set when the temperature falls below the "danger" point.

An automatic electric iron (fig. 8) has been produced by Domestic Electrification, Ltd. This is fitted with a strong and reliable thermostatic switch which cuts out and switches on as the temperature rises or falls below a predetermined level.

The "Hera" clothes-washer and boiler illustrated in fig. 9 is supplied by Messrs. L. G. Hawkins & Co., Ltd. This is a low-priced machine comprising a tank to which is fitted a motor-driven pump. No mechanical action is used in the tank—the water is swirled through the clothes and continuously agitated. Electric heating can be provided if desired. The tank has a white enamel finish relieved with blue.

Fig. 11.—The "Highlow" Luminous Radiator.

The next illustration, fig. 11, depicts a recent production of Messrs. Archibald Low & Sons, Ltd., a "luminous"-type "Highlow" radiator. It is strongly constructed with an ornamental brass guard mounted on a brass frame and feet. The heating elements are secured on a back plate, and lamps at each side of the radiator are enclosed in octagonal ruby glass. The radiator is made in various sizes, with loadings of from 500 W to 3,000 W. Various finishes can be supplied to match the decorations.

Electric Water Heaters.

Selections from the New and Improved Apparatus now upon the Market.

PROBABLY the direction in which the greatest advance has been made during the past twelve months in the design and production of domestic electrical apparatus is in connection with water-heating equipment. This has been due, no doubt, to the incentive given to the work by the supply industry generally in reducing tariffs, and particularly to the enterprise of those who have adopted specially low tariffs for water-heating supplies—ordinary and " off peak."

The following notes will, we hope, in outlining the trend of development, further encourage both the supply and manufacturing industries.

Revo Electric Co., Ltd., are making a special feature of electric water-heating apparatus for the coming season, and although they have not seriously altered their patterns, they are arranging for a much larger output to ensure prompt deliveries. The heating element employed in the apparatus is constructed to give a long life, and the tanks are efficiently lagged.

Fig. 1.—" Revo " Water Heater.

Fig. 2.—" Canvary " Water Heater.

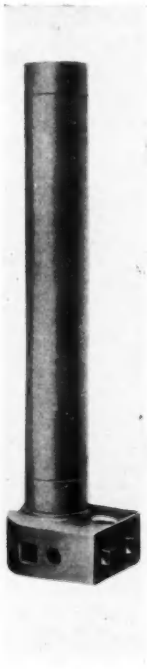


Fig. 3.—" Canvary " Element.

Fig. 4.—" S.P." Water Heater.

Fig. 1 shows one of the range of " Revo " water heaters, which are available in capacities of $1\frac{3}{4}$, 6, 11 and 22 gallons, with loadings, respectively, of 500, 500, 700 and 1,300 W. The heaters are entirely automatic in operation, and the water is maintained at a constant temperature (190 deg. F.) by means of a mercury-break thermostat controller.

The " Canvary " heaters introduced by Berry's Electric (1928), Ltd., some months ago have proved a success. They are supplied in the wall, fig. 2, and floor types, and are operated on the " push through " system, the control valve being placed on the cold-water side. There is a patented non-drip device to overcome the nuisance of continuous dripping after the cold water has been turned off, owing to expansion of water. By means of a special construction no metallic contact between the inner and outer cylinders exists. The thermostat is arranged to operate entirely without the use of springs, and on the small-size heaters it is plugged in, obviating the necessity of wiring to the elements. The heating elements, fig. 3, are of special robust construction, without loose spirals, and they can be used in any position—vertically or horizontally.

Another development of this company is the " S.P." or semi-pressure type of water heater, fig. 4, which is designed for a standard pressure of 80 lb. per sq. in., and is—unless otherwise specified—made in galvanised steel. A similar thermostat is used to that in the " Canvary " heaters, but in this case it is employed in a horizontal position. The elements also are of similar construction, but those of the 2-in. size are also used in the horizontal position, and are mounted on to a 10-in. hand-hole cover, providing ample space for defurring when necessary.

The immersion heater illustrated in fig. 5 is that employed by A. Reyrolle & Co., Ltd., for their various water-heating equipment. It is built up on a central metal rod on which a number of special refractory porcelain formers are threaded. These formers are bobbin-shaped, and have twelve equally spaced slots in which the heating element is held. The element comprises spirals of a high-grade, high-temperature resistance wire, and for a standard heater it is enclosed in a strong copper casing which is normally provided with a 2-in. thread for screwing the unit into the side of the tank. A collar is attached to the fixing nut to enable a packing washer to be used when necessary.

The units are manufactured in seven different sizes, ranging from 0.75 to 6 kW capacity, and are suitable for use on circuits up to 500 volts a.c. or 250 volts d.c. Elements of very low ratings can also be supplied for such special applications as heating wax. The heaters are fitted with metal-clad inlet sockets, and are wired for

either three-phase or single-phase circuits. The two-pin sockets on the single-phase heaters are made to British Standard Specification No. 196, and the three-pin sockets are similar in construction.

The Hotpoint Electric Appliance Co., Ltd., is concentrating its efforts upon the production of immersion heaters for use in existing installations. Each unit consists of a durable tinned-copper tube, inside of which is the heating element, firmly held in place and thoroughly insulated from the outside sheath or tube by a material having a melting point higher than that of steel. The units are fitted into a threaded brass collar to which they are brazed. The terminals, two in number, for the 600- and 750-watt, and 1-kW units, are equipped with nuts and washers for connecting to the power supply. The 3-heat units, having four terminals, are also equipped in the same manner. Three heats are obtainable on all the heaters excepting the 600- and 750-watt, and 1-kW units, which are single heat. Figs. 11 and 12 depict two styles of the " Hotpoint " heater.

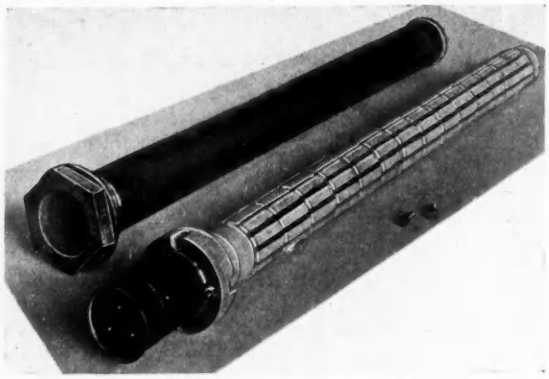


Fig. 5.—" Reyrolle " Immersion Heater.

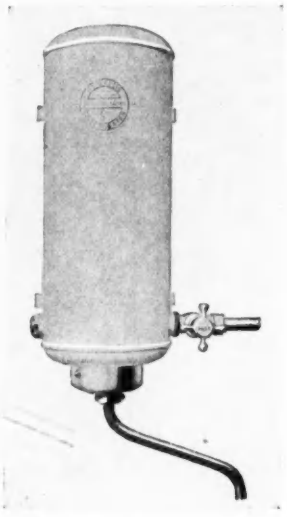


Fig. 6.—" Angelus Instanter " Heater.

Fig. 7.—" Creda " Automatic Water Heater.

Credenda Conduits Co., Ltd., are also giving considerable attention to the immersion-heater method for existing systems, and the following formula given by them for fixing a suitable loading should prove very useful: allow 1 kW for each 10 gallons of water in the storage tank; thus for a 30-gallon tank or cylinder 3 kW would be correct Better results would be obtained by dividing this loading over two immersers—one, say, of 1 kW, placed a few inches from the top of the tank, and one of 2 kW near the bottom. Two types of " Creda " immerser are available, the blade type, for which a short projection in the tank is essential (as with a small-diameter cylinder), and the tubular type, fig. 13, for all other purposes. The company also produces automatic water heaters which it advocates in preference to the former method on account of the very small heat losses. First cost may be slightly higher than in the case of an immersion-heater installation, but the saving in current will quickly make up for this. The main principles of the " Creda " heater, fig. 7, are a comparatively low loading, combined with automatic temperature control, and the very low heat losses. The outer body has an attractive finish, being white enamelled and lined in scarlet and gold. The heaters are made in a wide range of sizes, from $1\frac{3}{4}$ to 50 gallons.

George Green & Co. are supplying two types of water heater, the " Domestic " and the " Off-peak." The former is of the storage pattern, and is suitable for both hard and soft water. The internal container is constructed of copper and tested at 25 lb. pressure.

The heating unit is a " Gee-Gee " automatic immersion heater which " cuts out " when the water reaches a predetermined temperature and switches on again when the temperature falls 10 deg. F. The immerser is screwed into a handhole and is easily removed for cleaning.

The " Off-peak " water heater, fig. 10, overcomes the difficulty, it is claimed, of preventing the dilution of the hot water by make-up cold water during the time that the current is not " on." It incorporates a ball-valve cold-water feed tank, and it may, therefore, be connected direct to the cold-water main, the hot-water connection being near the bottom. In general con-

Fig. 8.—A " Heatrae F.B." Outfit.

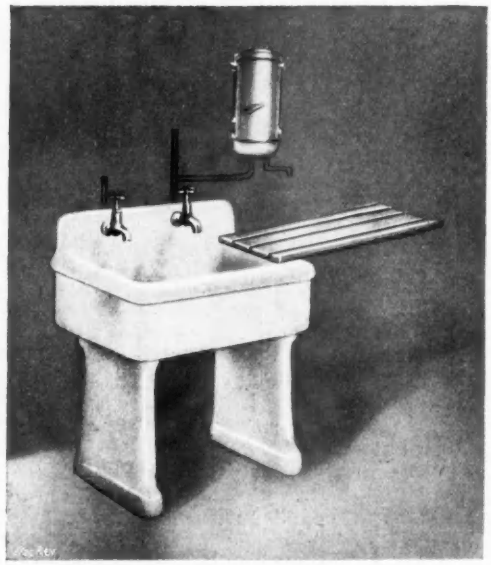


Fig. 9.—A " Jackson Quickservice " Installation.

struction, the " Off-peak " water heater is similar to the " Domestic " pattern, and it embodies, in the same way, the " Gee-Gee " automatic immersion heater. As the method of controlling " off-peak " loads varies with the district, a time switch, or other controlling device, has not been included. This heater is made in 30- and 40-gal. models, with loadings of 1,500 and 2,000 W.

The Jackson Electric Stove Co., Ltd., has recently introduced a new range of water heaters, embodying many improvements and alterations, which have been exhaustively tested under working conditions. The range includes a new type " Quickservice " model, fig. 9, of 1½-gal. capacity, suitably lagged and fitted with a British non-mercury-type thermostat for a.c. supply; where a d.c. supply only is available the company supplies a condenser fitted to each water heater. This heater is designed to give instantaneous supplies of hot water over sinks and lavatory basins, &c. As the interior is of tinned copper, the water is fit for drinking purposes, and it is interesting to note that water drawn at 190 deg. F. can be brought to boiling point on an electric boiling plate starting from cold in 3 to 4 minutes. The water heater is complete with an inlet tap and a swan-neck outlet, and is sold at a price not more than that of foreign water heaters of similar design. The range also includes standard storage water heaters of the lagged type, ranging from 6½ to 33 gal. capacity, and similar water heaters of from 11 to 33 gal. capacity, but embodying a ball-valve tank with each. With the exception of the " Quickservice " model all the heaters are offered with galvanised or copper interiors, alternatively.

The notes immediately following concern the " Angelus Instanter " water heater, fig. 6, which was introduced a few months ago by Charles Joyner & Co. It consists of an 11-gal. or 1½-gal. cylindrical iron tank finished in white enamel with nickel-plated fittings, and is provided with a 2.5-kW (11-gal.) or a 750-W (1½-gal.) two-bladed immersion heater. The tank is of the push-through type, and is always full of water. The outlet is quite open, and consists of a tube inside the tank, which leads from the surface of the water through the bottom of the tank, and finishes off with a nickel-plated outlet nozzle. The flow of the water is controlled by turning on the tap on the inlet side at the bottom of the tank. This water heater is claimed to meet all the requirements of the householder. Hot water for shaving purposes is obtainable in from three-quarters to one minute, sufficient hot water for washing purposes being available in from two to three minutes; the heater also meets the full requirements of the bathroom. The immersion heater is enclosed in a circulator, into which the water enters through holes at the bottom. The water is then trapped in the enclosed space round the heater, and is heated almost immediately. The heated water tends to rise through an orifice at the top of the circulator, but the flow is restricted by an ingenious " patent valve " device which rests on a seating at the top of the orifice. Through this valve is a small by-pass tube which leads to the surface of the water in the tank. This apparatus is fixed directly at the point of use, so that radiation losses are greatly eliminated.

The General Electric Co., Ltd., has recently standardised a range of storage water heaters which possess special features in robustness of construction, dependability, and economy in current consumption. These " Magnet " heaters were fully described and illustrated in the " Electricity for the Home " section in our issue of May 16th, 1930, p. 908.

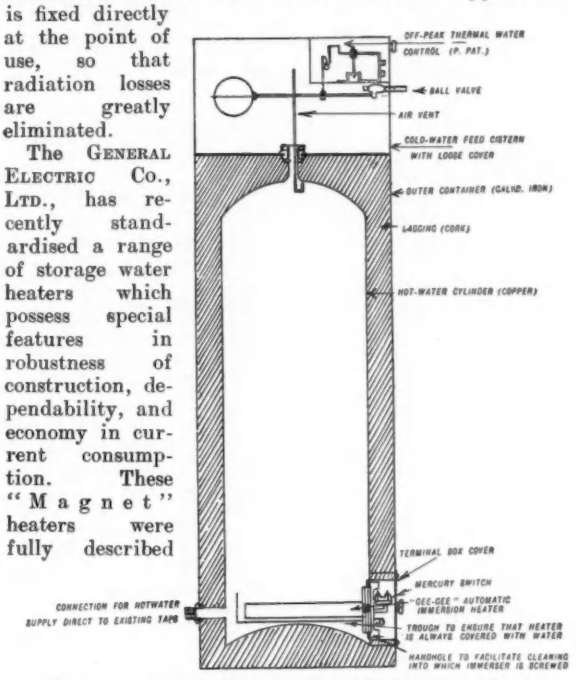

OFF-PEAK THERMAL WATER CONTROL (P. PAT.)
BALL VALVE
AIR VENT
COLD-WATER FEED CISTERN WITH LOOSE COVER
OUTER CONTAINER (GALVD. IRON)
LAGGING (CORK)
HOT-WATER CYLINDER (COPPER)
TERMINAL BOX COVER
MERCURY SWITCH
"GEE-GEE" AUTOMATIC IMMERSION HEATER
TROUGH TO ENSURE THAT HEATER IS ALWAYS COVERED WITH WATER
HANDHOLE TO FACILITATE CLEANING INTO WHICH IMMERSER IS SCREWED
CONNECTION FOR HOTWATER SUPPLY DIRECT TO EXISTING TAPS

Fig. 10.—Arrangements of " Off Peak " Water Heater.

Three types of " Heatrae " heaters, F.B., R.B., and R.T.A., are claimed by the makers, Electric Fires, Ltd., to be proving very satisfactory in every-day use. The F.B. heater, fig. 8, is of the ball-valve cistern type, suitable for supplying hot water to several taps; it can be connected directly to the water main. The hot water is taken from a union at the bottom of the tank, and pipes are run from this to feed the various taps. The tank is a complete hot-water system in itself, and no external expansion pipes are required. The rectangular formation results in the minimum of useful space being occupied. The heating is effected by a " Heatrae " immersion heater in the bottom controlled by an automatic temperature regulator. These tanks are made in sizes of from 5 to 30 gal. capacity. The R.B. model is a similar type of tank, but circular in form, with the result that it is slightly cheaper in first cost. An inexpensive automatically-controlled heater is the R.T.A. type, which is specially designed for wash basins and kitchen sinks. This is of the displacement type, the cold water entering at the bottom through a suitable control valve, and the hot water leaving at the top through a union and outlet pipe. A series of tanks of this type in capacities from 2 to 30 gallons are made as stock lines.

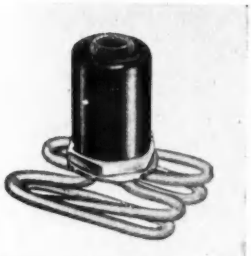


Fig. 11.—" Hotpoint " Flat Immersion Heater.

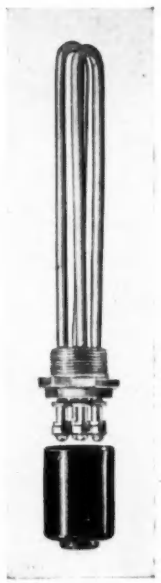


Fig. 12.—"Hotpoint " 2-kW Unit.

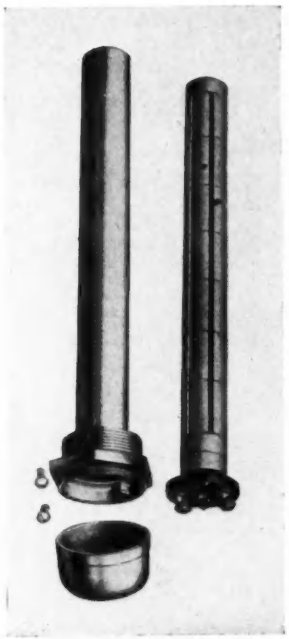


Fig. 13.—" Creda " Tubular Immersion Heater.

Electric Cooking Equipment.

Notes Depicting the Trend of Development in the Manufacturing Industry.

THE past year has brought about nothing drastic or revolutionary in the design of electric cookers. That is to the good; it has resulted in increased confidence in the present general design, confidence which was badly needed only a couple or so years back, which, in turn, is reflected in the progress figures for domestic electrification of most supply undertakings. Perhaps the most interesting development during the year has been the production of the British standard cooker to the specification of the I.M.E.A. Electrical Apparatus Sub-committee by a number of manufacturing firms in co-operation (Electrical Review, June 6th, 1930, p. 1085). Preliminary samples of this were shown at the I.M.E.A. Convention, and we learn that criticisms have been considered by the I.M.E.A. Sub-Committee, and that a new cooker is being constructed for the Committee which will meet the majority of the criticisms. We hope that the following notes, for which we are indebted to the various companies concerned, will assist the manufacturers, supply undertakings and consumers.

Fig. 1.—" Parker Smith "-Type Cooker.

Messrs. Archibald Low & Sons, Ltd., are still improving on their " Parker Smith " type cookers and " Highlow " utensils with self-contained heating elements. It is claimed that in some instances the electricity bill has been halved as the result of a " Parker Smith " type cooker being installed to replace an ordinary type of cooker with solid boiling plates. Fig. 1 shows one of the larger " P.S." type cookers; it is equipped with thermostatic oven control, a small warming cupboard, a large hot press, a grill and toaster, one boiling plate, and four pot sockets. The cooking pots are made of a special cast-aluminium-alloy, and the element cases are watertight, so that washing presents no difficulty. The pots are made in 2-, 3-, 6-, 9- and 12-pint sizes. The makers wish to draw attention to the fact that they make a specially enclosed 3-plug socket for mounting on any ordinary standard cooker, so that " Parker Smith " pots can be used.

In designing "Magnet " cookers the aim of the General Electric Co., Ltd., has been to embody three essential features: firstly, long life with minimum maintenance; secondly, heavy-gauge material throughout; and thirdly, attractive appearance. All hotplates and grillers are separately controlled by three-heat switches.

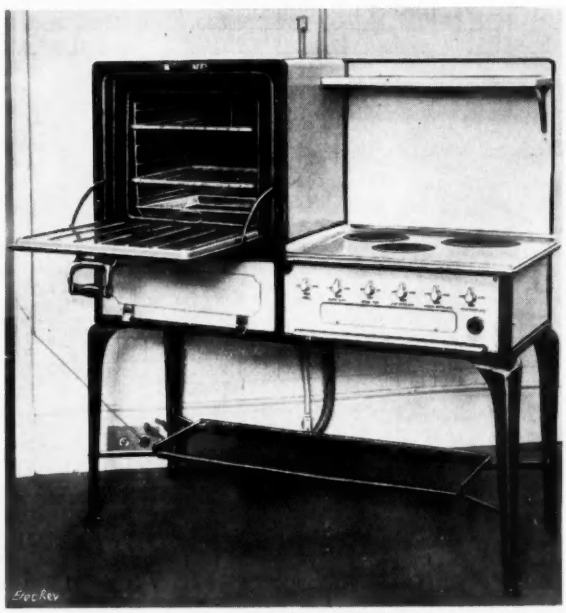


Fig. 2.—" Magnet " Table Cooker.

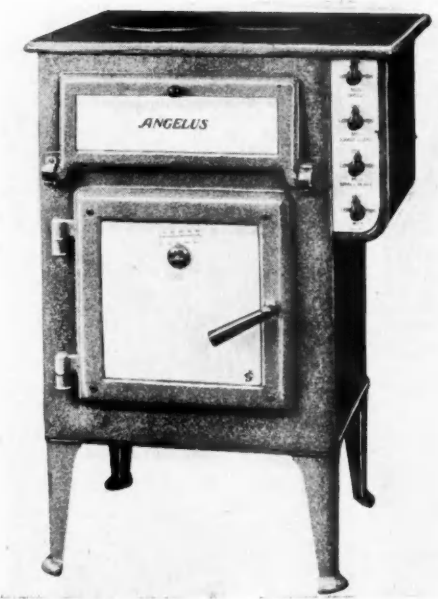


Fig. 3.—" Angelus " Medium Cooker.

None of the cookers are fitted with a combined grill and hotplate unit, as this is considered inefficient. The hotplates are of the totally-enclosed pattern, and they carry a guarantee of two years. An idea of the quick-

heating properties of these plates may be gathered from the fact that on an 8-in. plate, 1,600 watts, two pints of water can be boiled from cold in 8¾ minutes. Most of

Fig. 4.—" Plug-in " Element for " Revo " Cooker.

the new models are available in two finishes—" Standard " and " De Luxe."

The largest model of the new " Magnet " cookers, No. DC. 5718, fig. 2, is constructed of pressed steel throughout and has been designed for supplying to the oversea markets. It is suitable for families of up to 10 persons, and is supplied in an all " De Luxe " finish; its equipment includes an oven-heat indicator. Nos. DC 5731-2 fulfil the requirements of an average family of 8 or 9 persons. They are identical, with the exception that the DC. 5732 model has an additional 6-in. boiling plate loaded at 1,000 watts. No. DC. 5746 follows the same construction as Nos. DC. 5731-2 (the oven being smaller) and is suitable for an average family of 4-6 persons. No. DC. 5760 is the smallest of the range of pedestal cookers, and is suitable for a family of 4-5 persons. During the last two years there has been a demand for smaller cookers, and the " Magnet Minor " has therefore been produced. This apparatus belongs to the " breakfast cooker " class, and it has been specially designed to meet the requirements of small families of 3 or 4 persons, where not a great deal of cooking is done. It is equipped with a 7-in. or 8-in. totally-enclosed hot-plate and the oven is fitted with top and bottom heat, the top element being designed for use as a grill.

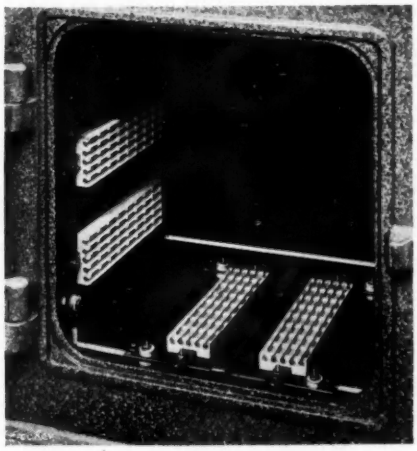


Fig. 5.—Constructional Features of " Carron " Oven.

Messrs. Charles Joyner & Co. have introduced a model which should prove interesting to electricity supply undertakings which are hiring out cookers. The " Angelus " medium cooker, fig. 3, is constructed very substantially, the castings being made of a special alloy containing nichrome, which, it is claimed, improves the finish and increases the strength. One of the features of the design is that all corners are nicely rounded off, enhancing the appearance considerably. The oven is withdrawable in one piece; it is finished in good-quality vitreous enamel, and is simple to remove for cleaning purposes. The elements are mounted on rust-proof rods, and the wiring is on the bus-bar principle, each circuit being separately fused. The elements are easy to replace and are of a flexible nature. This cooker is designed to cover all the needs of the average family of 5 to 7 persons, and it is supplied in either the standard and " De Luxe " finishes.

Styled as M.1, M.2, M.3 and P.2, Carron Company has recently introduced four new cookers. The chief points of variance in these models relate only to size, and the following notes are taken from the specification for the M.1 cooker.

The oven has a detachable interior, and the inside casing is vitreous enamelled, as is also the oven interior. The heating elements, fig. 5, are disposed at the sides and bottom of the oven; they are fitted to coppered bus-bars, and they may be removed for replacement or inspection by the removal of two knurled nuts. The performance of the oven is such that 340 deg. F. is obtained 20 minutes after switching on. The oven itself is fitted with louvres at the bottom and holes at sides and top to assist heat circulation and to maintain a constant and uniform temperature throughout. All the boiling-plate and grill connections are fitted with plug-in terminals mounted on special brackets to facilitate replacement, if necessary. In " De Luxe " (C) finishes a six-inch cast-iron white-enamelled back skirting is provided. " Hart " three-heat reciprocating switches are used and are positioned at the right of the oven under an indicating white-enamelled plate. Any one switch may be dismounted for replacement without disturbing the general assembly. The fuses are mounted beneath the switches and are accessible from the front of the cooker. The wiring is on the bus-bar system as far as possible.

The Hotpoint Electric Appliance Co., Ltd., has introduced a range of cookers similar in most respects, except for features pertaining to size. Each is in all mottled grey vitreous-enamelled finish, and is equipped with a cast-iron grill door having a white vitreous-enamelled panel. Fig. 6 shows the hob raised on its hinges at the back, exposing the boiling plates, grill and switch assembly and wiring, as used in the latest models. It will be seen that the whole of the wiring is easily accessible. An interesting feature is that the leads under the hob are run in cast-iron vitreous-enamelled channels. The switch assembly is in one unit, and includes the fuses and main terminals. Provision is also made to prevent liquids spilt over the plates reaching any of the wiring or the terminals.

The plug-in oven element, fig. 4, fitted to the " Revo " cookers of the Revo Electric Co., Ltd., is claimed to be an advance on anything that has been done in this respect, and it has been made possible by

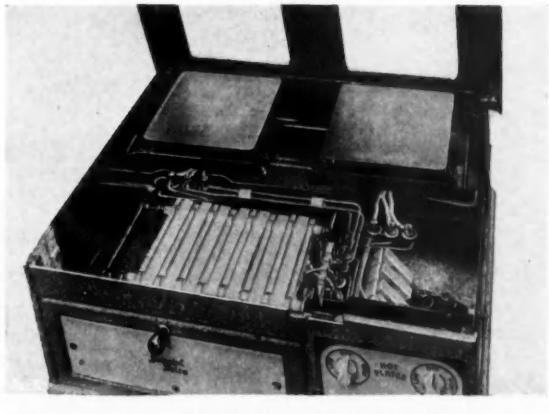


Fig. 6.—Hob Arrangements of " Hotpoint-Falco " Cooker.

the evolution of a suitable plug and socket which is not affected by local heat and therefore retains its resilience over an indefinitely long period. A very smooth action

is obtained, and a maximum area of contact prevents any possibility of arcing and resultant corrosion. This contact is obtained by the utilisation of a steel ring which encircles the brass socket. The socket is split into four segments, while the male portion is solid. A notable feature of this new-type oven element is that it is both very simple and robust. It is constructed of two flat heavily-plated steel shells, the lower shell containing troughs, with high-grade moulded insulation, in which the element wire is laid. A very low loading per square inch is obtained, namely, approximately 3.125 watts.

Fig. 12 depicts the standard cooker developed by Messrs. Archibald Kenrick and Sons, Ltd. It is made in four sizes, the smallest being suitable for 2 or 3 persons, while the largest will cook for a family of 12. The cooker is strongly made of cast-iron and steel plate, and is finished in two varieties of vitreous enamel. The oven interior is made in one piece, vitreous enamelled, and is easily cleanable after cooking. The oven elements are of a special bar type, strong, durable, and safe. They can be quickly and easily removed when necessary. The circular boiling plates set in the hob are of the totally-enclosed type, and it is claimed that saucepans will simmer on any part of the hob when the boiling plates are in use. The grill, which is placed inside the hot-plate, has a heating surface of 9 in. × 7½ in.

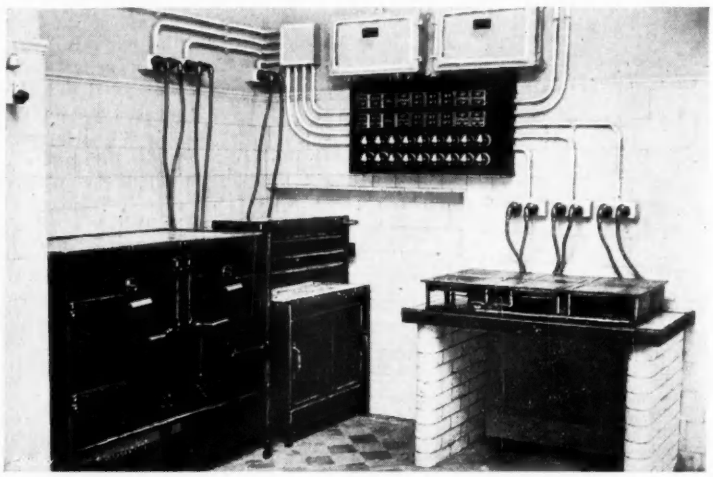


Fig. 7.—" Arora " Cooking Equipment in Large Residence.

In fig. 7 is shown one of the latest cooking installations manufactured by the Arora Co. for a large private residence. The special feature is that the large double oven, each compartment measuring 2 ft. × 2 ft. × 2 ft., is heated by the " Arora " new safety tubular heating elements, completely iron armoured. The same applies to the hot cupboard (not shown in the illustration) on the other side of the kitchen. The central indicating switchboard controls the whole kitchen equipment. This company has also adapted the tubular elements to the smaller domestic ovens, and it finds that an oven of the normal domestic size, 13 in. × 14 in. × 15 in. clear cookng space inside, with the very efficient heat lagging walls, is giving splendid results, not only as to the uniformity of cooking, but also in the ability to maintain this size of oven at 300 deg. F. with a loading of only 375 W.

While no radical changes have been made in the " McClary " cooker of Berry's Electric (1928), Ltd., several noteworthy improvements have been incorporated. The enamel cooking hob to-day is entirely without screws going through from the top surface. The hot plates, which were already of high efficiency, have still further been improved by the introduction of a one-piece porcelain former, embodying the insulating pad at the base, instead of the sectional type used last year. The housing for the springs of the oven door has been re-arranged to take a stouter spring. Other minor improvements, such as bolder rounding off of the hob plates, oven doors, &c., have added to the attractiveness of this cooker, fig. 8.

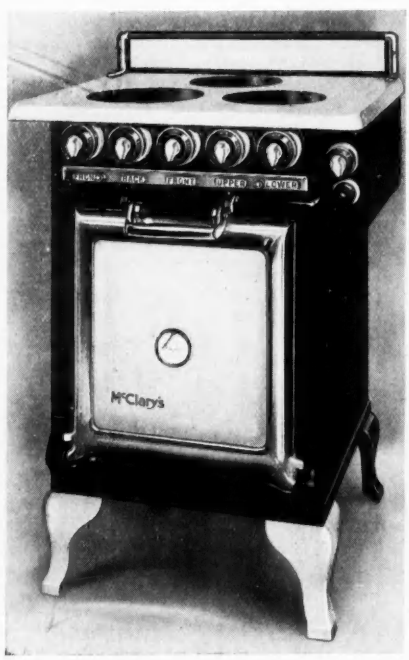


Fig. 8.—No. 5 " Berry McClary " Cooker.

Fig. 9.—A New " Telac " Control Unit.

Fig. 10.—Large " Creda " Domestic Cooker.

Messrs. J. H. Tucker & Co., Ltd., believe the range of cooker-control equipment produced by them to be more comprehensive than that of any other manufacturer. The range of equipment available is such that a suitable cooker control unit for any cooker up to 7 kW total loading is available. A new unit developed

by this company is depicted in fig. 9. It is similar to the standard pattern, but it is fitted with an internal pilot lamp and a red or white bull's eye. This control apparatus is available with a 5- or 15-A. sub-circuit B.S.S. socket of the 2- or 3-pin type. In all " Tucker " control units are fitted quick-make and quick-break positive action main and sub-circuit switches; a Home Office type cut-out rated at 15 A., for the protection of sub-circuits; and B.S.S. 5- or 15-A. 2- or 3-pin sockets. The complete equipment is housed in a single cast-iron case, or on 5-ply board in the case of the unit for miniature cookers.

" Creda " cookers of Credenda Conduits Co., Ltd., are available in wide variety, from the breakfast grill or small cooker for two, up to the large heavy-duty apparatus for the hotel, restaurant, or canteen. We illustrate in fig. 10 one of the latest pattern domestic-type " Creda " cookers, which are made in six standard sizes. A full description of this model appeared in the Electrical Review of July 25th, 1930, page 133, but it may be useful to recapitulate the principal features, most of which are fully patented and protected. All the elements are of the plug-in type and have suitable earthing pins which take the weight off the current-carrying pins. The ovens have an entirely new system of heating by means of vitreous-enamelled tubes, which form also a support for the cooking shelves, thus giving larger oven capacity and enable a patented non-tilting shelf to be employed. The oven door has a slam latch, and the door plate is domed. A novel design of vitreous enamelled grill pan is fitted, and there is an extra-large plate-warming compartment. The finish is all-enamel.

Considerable attention is given to time and temperature control by Messrs. L. G. Hawkins & Co., Ltd., in connection with their " Universal " cooking equipment. The oven time control unit automatically switches the elements " on " and " off " at any times desired, and it requires no more attention than the setting of the indicators. It is claimed to be noiseless and positive in action, and to operate satisfactorily on either a.c. or d.c. Most of the cookers are equipped with a timer connection, which permits the unit to be added easily at any time. The control units are supplied in any finish to match any of the cookers.

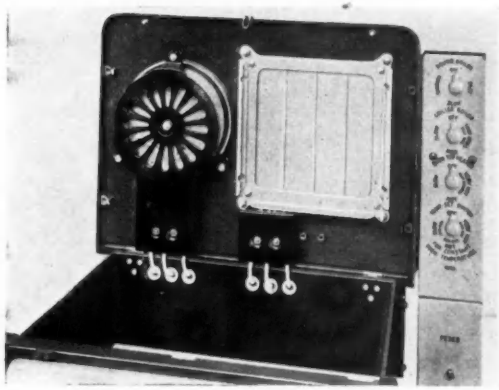


Fig. 11.—Hob Arrangement of No. 34 " Belling " Cooker.

Fig. 12.—An " Archibald Kenrick " Cooker.

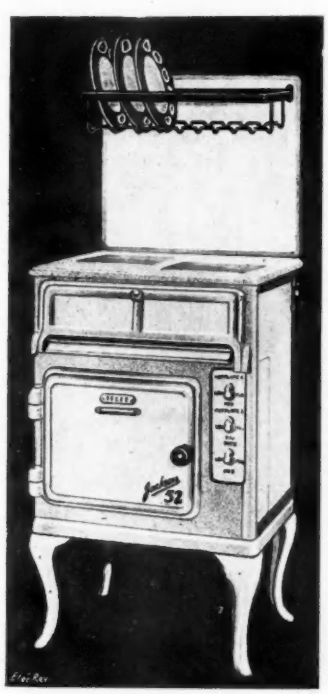


Fig. 13.—No. 52 " Jackson Beauty " Cabinet.

The construction of the " Universal " temperature control apparatus is depicted in fig. 14. It consists essentially of a steel rod and a brass tube fastened together at one end, the brass tube being anchored to the bronze supporting plate of the oven temperature control at the back of the oven. As the heat in the oven varies, the brass tube expands and contracts, moving the steel rod backwards and forwards a very minute distance. The entire flow of current to the oven is through the mercury tube. Tilting the tube makes and breaks the circuit.

The Jackson Electric Stove Co., Ltd., assures us that the " Jackson Junior " cooker has proved to be the success predicted. It may be obtained with one or two boiling plates, as required, the grill-boiler being a feature which has helped towards its general popularity. The following notes are taken from the general specification for the comprehensive " Jackson Beauty " series of cooking cabinets. The cabinets are constructed of cast-iron and sheet steel in a manner combining lightness with strength. They each comprise an oven surmounted by a hob, and embody a warming cupboard of generous size between the hob and the oven. The oven interior is of steel plate with well-rounded corners, and the whole of the interior is finished in mottled-grey vitreous enamel, including the shelves and element guards. At the bottom of the oven the interior is fitted flush to the cast-iron front frame, ensuring easy cleaning. The elements, which are arranged at the side and side-bottom, are mounted on frames positioned near the bottom on each side by grooved pins fixed on the oven side. The hob is constructed of cast-iron, and the boiling plates are of the enclosed type—very rapid in action. The hob is hinged and easily lifted for inspection purposes; in the " lifted " position it is held by an automatic locking device. The hot chamber is provided with a spring-loaded drop-down door with white-

enamelled panelling. The connections on the cooker are, as far as possible, of solid strip and, where necessary, are insulated by fire-proofed material. The terminals of the hotplate and grill are connected to a terminal plate on the underside of the hob by fire-proofed cable, and a multi-core cab tire-sheathed cable connects these terminals to a similar set in the control chamber. Fig. 13 shows the No. 52 " Jackson Beauty " cabinet, which is designed to serve for 3 to 5 persons. It has total loading of 4,500 W.

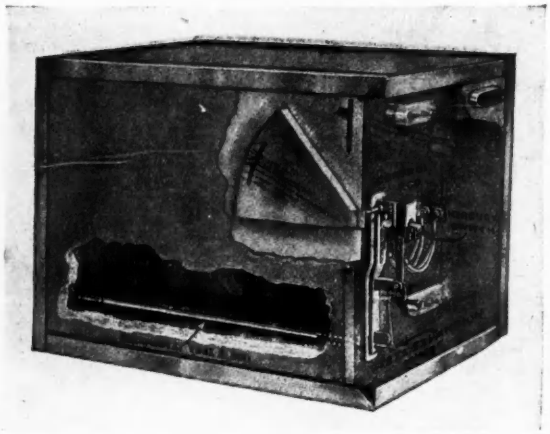


Fig. 14.—" Universal " Temperature Control Apparatus.

The latest production of Messrs. Belling & Co. is the No. 34 cooker, which is believed to be a very popular model for families of 4 to 6 persons. It is made of cast-iron and steel plates, and is attractively finished in mottled and white enamels. It is claimed that the oven incorporates every detail that both housewives and engineers appreciate. A special type of ventilator is fitted at the back of the oven. It is automatic in action and allows steam to escape without loss of heat, and it prevents condensation. The oven attains a temperature of 400 deg. F. in 20 minutes with both switches " full-on," after which almost any desired temperature can be maintained evenly by operating the bottom switch (the " Temp.-Set "), the top switch being used mostly for browning purposes only. The " Temp.-Set " at " very hot " gives a constant temperature of between 350 and 450 deg. F., at " hot " 300-350 deg. F., and at " slow " 220-300 deg. F. Two three-heat new-type plug-in elements, each 1,000 watts, are fitted in the oven, one at the top and one at the bottom. The hob is hinged at the back, and extensions can be fitted to either side if desired. The wiring for the boiling plates is very simple, as depicted in the accompanying illustration, fig. 11. All the electrical connections are carefully protected from spilt liquids. The boiling plate (1,200 W) is made of a special alloy and is grooved on the underside. A beaded spiral lies in these grooves and is kept in position by a heat-resisting brick.

During the last twelve months the main development work by Siemens Electric Lamps & Supplies, Ltd., has been in connection with the British " Standard " cooker, the object of which has been to produce one or more models embodying the best features of modern practice, with a design to meet the requirements of most of the supply undertakings of the country.

Fig. 15.—" Xcel Glasgow " Cooker.

Many detail improvements have been introduced recently in " Xcel " cookers, and the present range of apparatus is claimed to meet all requirements. The standard finish now includes a vitreous-enamelled hob and oven lining, while the heavy sheet-metal sides and back of the cooker, as well as the actual oven inner body, are also vitreous enamelled. A white vitreous-enamelled switch plate, with clearly marked lettering, is now fitted which, together with the enamelled hob, considerably improves the appearance. The boiling plate adjustment has been improved in the latest models, with a corresponding reduction in the space occupied, leaving more available room for the hot-cupboard. Cookers of this make have been adopted by some of the largest supply undertakings, including Glasgow, fig. 15.

Recent development work by the Manor Electric Oven & Fire Co., has resulted in the production of table cooker No. 1,275, suitable for eight to twelve persons; cooker No. 1,273, suitable for four to six persons; and a two-tier pastry oven, No. 1,276. The following are the principal constructional features of the " Manor " apparatus; the wiring is fitted behind the splash backs; all the wiring is of pure nickel, and so arranged that in the event of a boil-over it is protected from damage; " plug-in- " type elements, fig. 16, are fitted; all cooker hobs, oven interiors, door panels, splash backs, and crown plates are vitreously enamelled as a standard practice, and on the table cookers the pot shelf is also vitreously enamelled; all sheet metal, if not vitreously enamelled, is treated with a rust-preventive compound, stoved on; all switches and fuses are fitted behind the splash back or switch panel, and they are protected, the knobs of switches only projecting from the surface; the switch indications are also vitreously enamelled on the panels; a large plate heating space is provided on all cookers.

The cookers produced by Domestic Electrification, Ltd., have a high-class finish, and the construction is robust. Great care has been taken to eliminate dirt traps and consequent corrosion, and to this end the makers have taken the precaution of vitreous enamelling, with a double coating, all sheet-metal parts in the more remote and inaccessible parts, while all internal surfaces that are liable to come in contact with fats are finished in vitreous enamel. The plug-in elements are of a special design, giving seven different loadings.

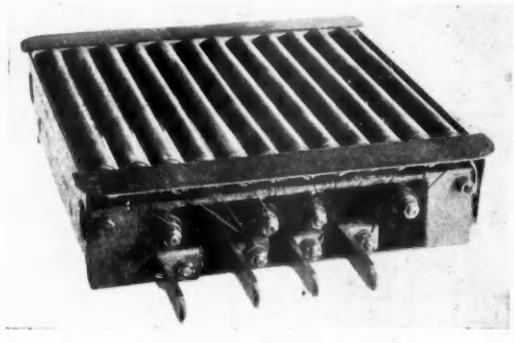


Fig. 16.—" Manor " Plug-in Element.

Industrial Electric Furnaces.

Examples of the Wide Variety of Equipment Available for all Purposes.

IT is believed by experts on the subject that the industrial electric heating load will, before long, be as big as, if not greater than, the power load. The possibilities are very apparent; all industries require heat in some way, and the very comprehensive range of apparatus at present on the market, from large heat-treating furnaces for metals to the small joiner's glue pot, shows clearly that all can be adequately served. We hope the following notes on the various manufacturers' products will prove useful in showing what kinds of apparatus are now available and in pointing to the trend of development.

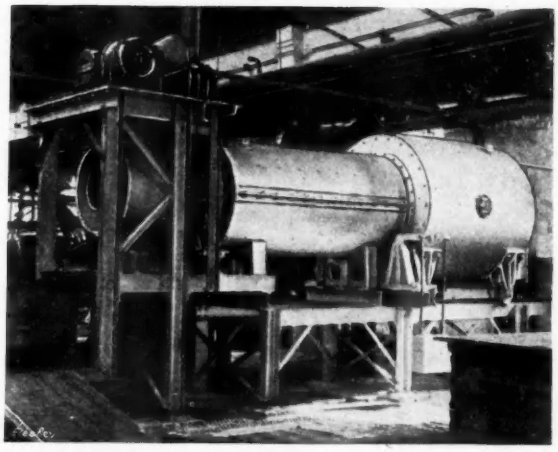


Fig. 1.—" Birlec " Revolving-drum Annealing Furnace.

Birmingham Electric Furnaces, Ltd.

Fig. 1 shows a " Birlec " recuperative, revolving-drum furnace installed at Messrs. I.C.I. Metals, Ltd. (Kynochs), for annealing cartridge cases. The following notes are taken from the consumers' report:—The consumption of electrical energy was guaranteed at 95 kWh, running continuously, and the actual result was 64 kWh per ton, allowing for all standby losses, for day working only. The furnace has a maximum rating of approximately 90 kW. Utilisation is made of the counter-flow principle in which the material to be treated is fed into an inner drum from a hopper and is propelled along this drum by a helix towards the heated end of the drum. Having travelled the full length of the inner drum into the heating zone, the material falls by gravity into the outer drum, and returns in the annular space between the two drums, again being propelled by a helix until it is finally discharged through a chute in the bottom of the furnace. During the return flow the heated work moves in contact with the walls of the inner cylinder, containing relatively cold work, and, as the inner cylinder is made of heat-conducting metal, heat is absorbed by the incoming work during its travel towards the heating chamber itself, thus resulting in a considerable saving of energy. The method of construction adopted facilitates access to the rotating drum and the heating elements. The insulated casing of the recuperative portion of the drum is made in two halves—the upper of which can be turned back on its hinge, exposing the drum for inspection. In addition the cylindrical structure containing the heating elements is supported on rollers, and can be moved horizontally away from the rotating drum, leaving the centre of the drum exposed and permitting of free access to the heating elements. In order that the rotating drum and its load will have adequate support, the heated end has a trunnion which extends through an aperture in the end of the heater casing, and is supported by external bearings. Intermediate bearings are also provided, and these, together with the hopper end bearings, serve to support the drum when the heater end trunnion is left unsupported by withdrawal of the furnace itself. The driving gear, which consists of the motor, reduction gearing, and variable-speed gear, is mounted at the charging end of the furnace on a raised platform to allow of free access to the charging hopper and the discharge chute.

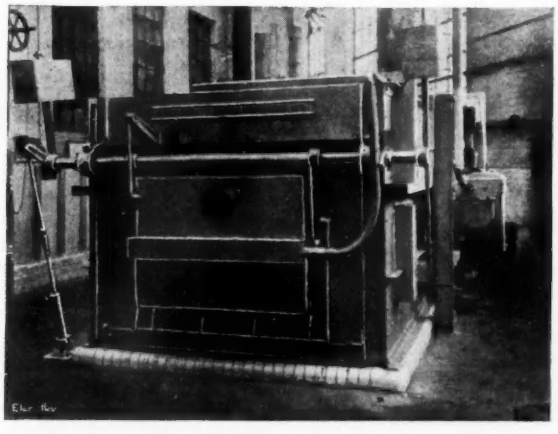


Fig. 2.—Large " Birlec " Carburising Furnace.

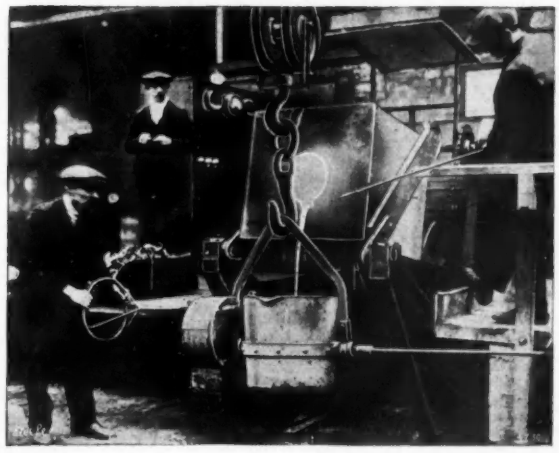


Fig. 3.—" Met.-Vick." Non-ferrous Furnace.

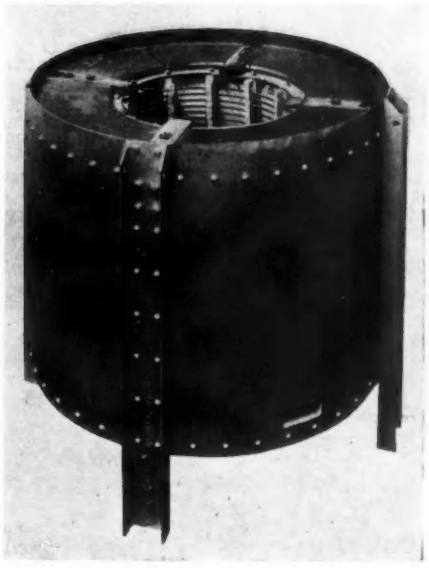


Fig. 4.—An " EFCO " Pot Furnace.

A double-ended " Birlec " furnace, fig. 2, installed in the works of Messrs. David Brown & Sons (Huddersfield), Ltd., is believed to be the largest electric carburising furnace in this

country. It has a maximum rating of approximately 200 kW at 400 volts, 3-phase, 50 cycles. The effective hearth area is 14 ft. long by 3 ft. 3 in. wide, with a door opening 3 ft. 3 in.

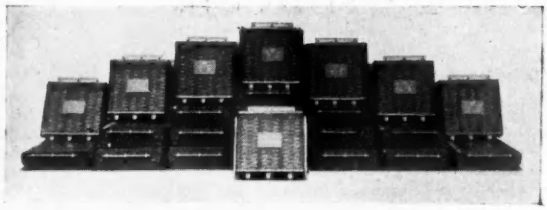


Fig. 5.—Cable-heating Elements; " EFCO."

wide by 2 ft. 2 in. high, the overall dimensions being 19 ft. long by 8 ft. 6 in. wide. The heating elements are located on the sides, roof, underneath the hearth, and on the doors, and they are divided into two entirely separate circuits, each

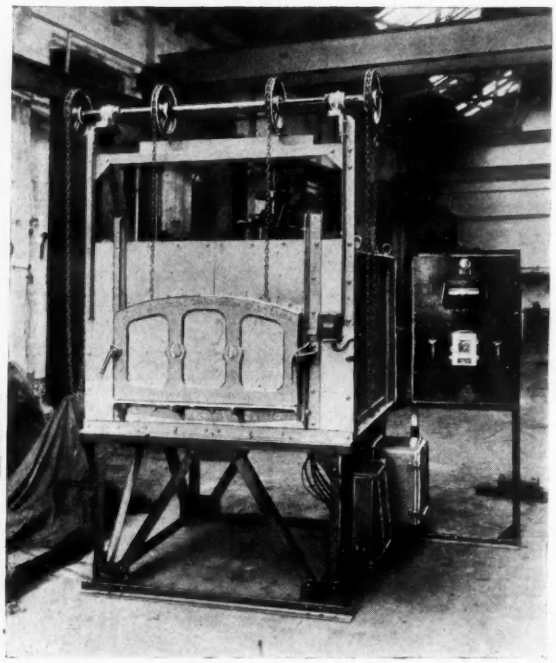


Fig. 6.—" Lecfur " Carburising Furnace.

circuit contributing a fully-balanced, three-phase load. These zones each cover one-half of the furnace, and are separately and automatically controlled. By this means each half of the furnace can be maintained at different temperatures, or both halves may be run at the same temperature. The doors, which are of the " Birlec " patent, parallel-motion type, are equipped with dash-pot control to prevent any jarring when closing. The furnace is used for the carburising of long worm shafts and heavy gears, and for the heat treatment of large gears. The temperature controllers will regulate the furnace temperature to plus or minus 3 deg. C., and the temperature variation from end to end of the furnace is less than 6 deg. C.

Metropolitan-Vickers Electrical Co., Ltd.

Many coreless induction furnaces are now in successful operation for steel melting, but it is of special interest to note that among equipments recently ordered from the Metropolitan-Vickers Electrical Co., Ltd., is one for non-ferrous work. This order has been placed by Messrs. Hopkinsons, Ltd., makers of high-grade steam valves and boiler fittings. The equipment is to be installed in the firm's " Platnam " foundry, where special alloys are melted for this work. The furnace is of the " Met-Vick " standard type, of 1/4-ton capacity, and is designed to melt its full charge in one hour from cold. The furnace proper is contained in a steel case which is equipped with motor-driven tilting gear. The supply of power to the furnace is provided by means of a motor-generator set taking power from the mains at 440 volts, three-phase, 50 cycles, and generating at 1,000 volts, single-phase, 500 cycles. The equipment will include condensers for power-factor correction and equipment for automatic voltage control. The latter provision is of importance, in that it leaves the operator free to concentrate his attention on the metallurgical considerations of the work. The service for which the furnace is required is an interesting example of the class of work for which this type of melting equipment is particularly suitable. The manufacture of metal parts, especially valve seatings, for use under steam conditions of high temperature and pressure, requires exact control with regard to the materials and processes used. Fig. 3 shows a furnace similar to that being supplied to Messrs. Hopkinsons, Ltd.

Electric Furnace Co., Ltd.

Within the last year the Electric Furnace Co., Ltd., has installed, it is claimed, the largest Ajax-Northrup steel-melting furnace in the world, having a melting capacity of one ton per hour; the motor-generator equipment operating this furnace is rated at 650 kVA. A similar equipment is also in the process of construction, and will be started up within the next few months. Three of the largest Ajax-Wyatt brass-melting furnaces, 240-kW capacity each, have also recently been set in operation in a Birmingham works; these have two secondary channels and give an output of 20 to 25 cwt. of 60/40 brass per hour.

The activities of the subsidiary company, the Electric Resistance Furnace Co., Ltd., have been none the less marked.

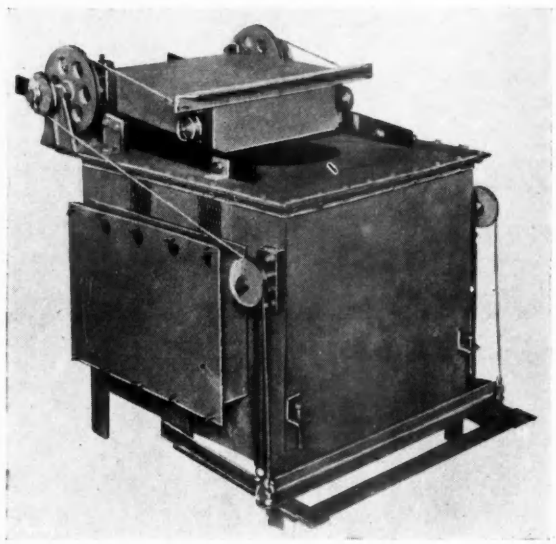


Fig. 7.—Valuable-metal Melting Furnace; " EFCO."

There has been an increasing demand for what are termed pot furnaces, in which the metal is held in a refractory container which is heated externally by resistor elements. This system of heating is very efficient and has proved itself particularly advantageous where strict temperature control is imperative if uniformity of product is to be ensured. It is adaptable in cases where the comparatively large capital outlay for an induction furnace would render electric melting prohibitive. A specific instance of its economic value is in the holding and superheating of molten aluminium prior to casting. It is claimed that no other system could conform to

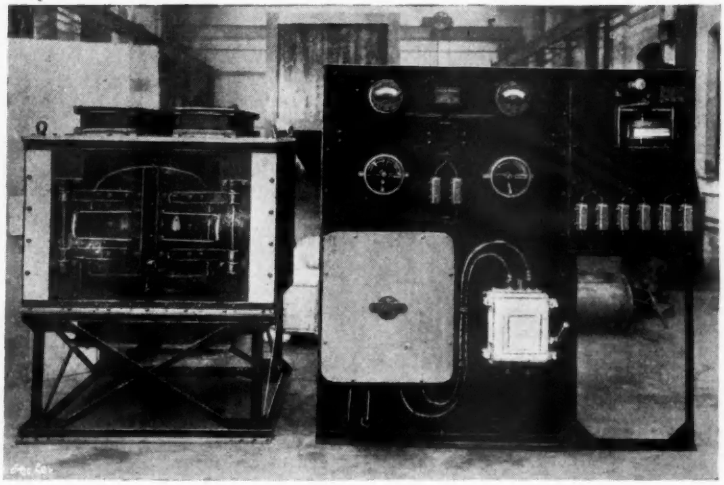


Fig. 8.—" Lecfur " High-speed Steel Furnace.

the temperature requirements of this process, where soundness of product is the prime consideration. The outstanding feature of the "EFCO" melting and holding pot is the resistor element, which embodies a helical coil of a very substantial gauge of nickel-chromium rod. Under the conditions obtaining in pot furnaces, a fairly steep temperature gradient between the resistor element and the pot is inevitable,

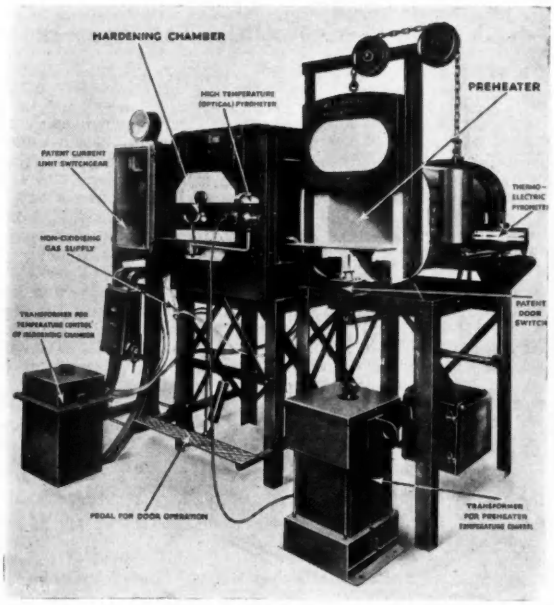


Fig. 9.—" W.B." High-speed Steel Furnace.

and such a type of heater offers obvious advantages if long life and service are to be obtained. Fig. 4 is a view of one of these furnaces, showing a portion of the heater coil.

Metallic resistors, however, are limited to a certain temperature range, and conditions requiring a wire temperature exceeding 1,100 deg. C. are impracticable. It is obvious that for the melting of valuable metals, such as silver and gold, or small quantities of alloys such as bronzes, for experimental purposes, requiring a melting temperature of between 1,000 deg. C. and 1,200 deg. C., a metallic resistor element is unsuitable. For this purpose a crucible furnace designed in the first place for gold melting has been constructed with resistor elements of non-metallic rods made of a special composition of recrystallised carborundum. This type of furnace is illustrated in fig. 7. The furnace, it will be seen, has a special foot-operated cover which leaves the operator with both hands free for the removal of his valuable product.

This company has also produced a range of furnaces suitable for carrying out the new "Nitrard" process, by which special steels are case hardened in a nitrogenous atmosphere. By a suitable disposition and grading of the heating elements, combined with a special design of door-jamb insulation, the makers are able to guarantee that the temperature difference between any two points in the furnace will be less than 5 deg. C.

In the cable industry an application for electric heating has been found for the heating of cables in an evacuated chamber prior to impregnation. The heaters are of two types—tubular and panel; a group of the latter class produced by the company is shown in fig. 5.

Considerable experimental work has been carried out in connection with the bright annealing of metals, and a successful design of installation has been evolved for the bright annealing of copper, silver, cupro-nickel and other ferrous and non-ferrous alloys. In the ceramic industries the appreciation of the benefits of electric heating is widespread, and the subsidiary company has recently started up a further double-way regenerative decorating kiln (80 ft. long).

Leeds Electrical Construction Co., Ltd.

In fig. 8 we illustrate a large "Lecfur" electric furnace designed for temperatures up to 1,350 deg. C. It is equipped with double doors, and is of the type supplied to the British Admiralty for the heat treatment of high-speed steels. The panel at the side of the furnace is equipped with automatic control gear for maintaining regularity of the furnace temperature. Another large "Lecfur" furnace for temperatures up to 1,000 deg. C. is depicted in fig. 6. It is used for firing vitreous enamelware and for carburising, or any other heat treatment within its temperature range. This furnace also is provided with automatic control gear, and it is also fitted with a time switch, so that the furnace will automatically switch on without attention at such a time as will permit of its being up to its working temperature when the operatives commence work.

Wild-Barfield Electric Furnaces, Ltd.

In a large low-temperature furnace recently produced by this company for the heating of aluminium alloy billets for forging, two paddle fans are situated in the roof. These fans are driven through reduction gearing by one motor outside the furnace, a recent improvement which is the subject matter of a patent. The special fans ensure a uniform distribution of heat throughout the work placed in the furnace.

Fig. 9 depicts another recent W.-B. development, consisting of a high-speed steel furnace with hardening and preheating and tempering chamber. The elevated temperature required for the hardening chamber is obtained by passing the current through bars of re-crystallised carborundum, the heating bars being situated in the sides of the chamber in specially designed bricks with parabolic reflecting grooves. The temperature control is effected by a patented combination of a tapped transformer and a circuit breaker which automatically overcomes the disadvantages associated with the negative temperature co-efficient of the bars. The temperature of the work is measured by means of an optical pyrometer fixed to a swing arm. The preheating and tempering chamber is fitted with an indicating pyrometer as an easy means to check the operating temperatures. The temperature of this chamber is controlled by the tapped transformer, and the furnace is specially designed to give the low temperature required for tempering and the higher temperature required for preheating. The total loading is about 20 kW.

In the installation depicted in fig. 10 are included three carburising furnaces for shackle bolts and gudgeon pins, three

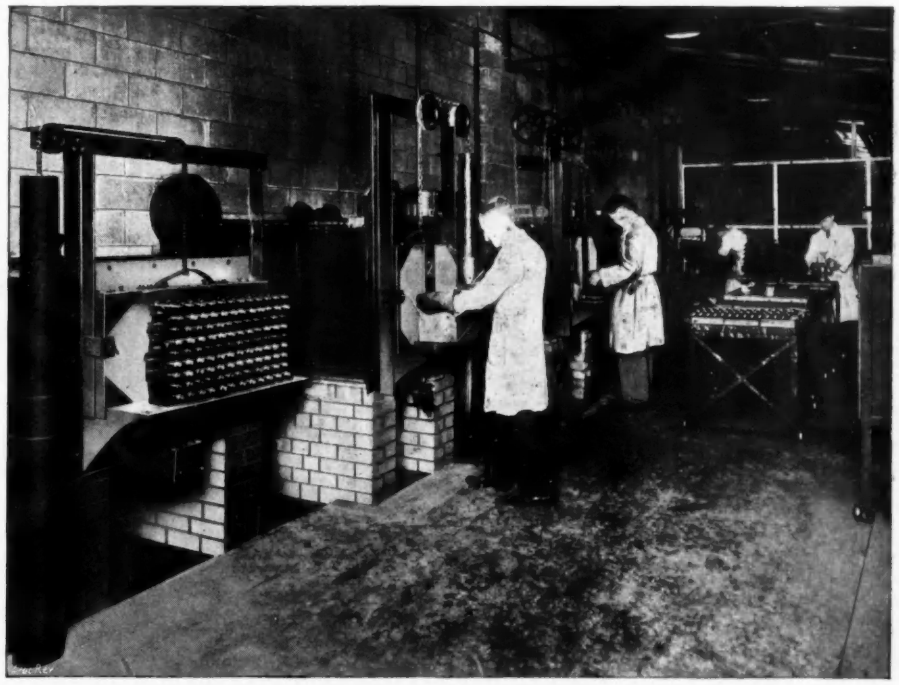


Fig. 10.—" W.B." Equipment in Modern Hardening Shop.

electro-magnetic furnaces for reheating and hardening, and one high-speed steel-hardening and tempering equipment in what is believed to be probably the most modern hardening shop in the United Kingdom. The carburising furnaces are all automatically controlled for time and temperature and the hardening furnaces are fitted with electro-magnetic indicators.

(To be continued.)

Electric Welding Equipment.

Notes Depicting the great Progress made in the Production and Control of Electrical Apparatus.

ELECTRIC welding is fast increasing its field of operation, and is effecting remarkable economies in many directions in industry, for instance, in the construction of steel-girder buildings, in building "fabricated" machines, in the repair of worn railway lines, and so on. We hope that the following notes and illustrations we have selected from the products of various manufacturers will give our readers a useful impression of the class of electric welding equipment which is now available.

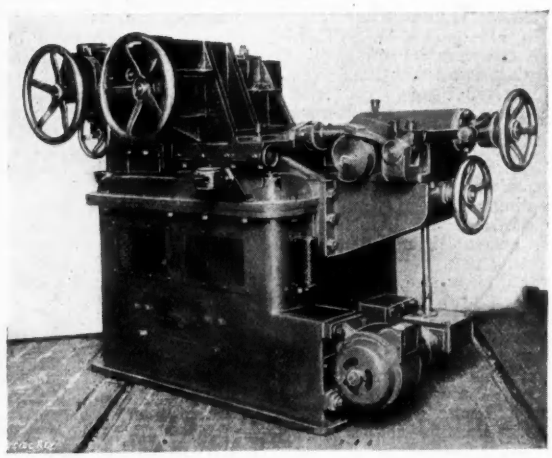


Fig. 1.—"B.I.C." Automatic Butt Welder.

British Insulated Cables, Ltd.

One of the latest machines to be introduced by this company is the No. 92 automatic butt welder illustrated in fig. 1. It is suitable for welding all forms of tubes and section metal, and outputs up to 120 pieces per hour may be obtained, depending upon their shape and ease of clamping. The parts to be welded are clamped in the usual manner, and the machine is then set in operation by a small switch which allows the slide to move backwards first, leaving a gap between the parts being welded. The current is then switched on, and the slide moves forward at a pre-determined rate. During this forward movement the flashing takes place, and when the ends of the material are incandescent the maximum upsetting pressure is applied and the current switched off. Reversal of the control switch opens the slide ready for the next operation. This form of power drive may be fitted to all machines up to the largest size. The machine is suitable for slow welding mild-steel sections having cross sectional areas up to 3 sq. in. It consists of a single-phase alternating current static transformer enclosed in a cast-iron body and fitted with the necessary clamps and control gear. The capacity of the transformer is 50 kW for slow welding and 80 kW for flash welding. An a.c. contactor connected to the main source of supply and arranged for wall mounting is supplied for making and breaking the supply to the machine. This contactor is operated by a two-way "open" and "close" push button conveniently fitted to the welder. A knock-off switch fitted at the back of the machine is operated by an adjustable knock-off rod attached to the saddle. When slow welding the circuit may, if desired, be controlled by means of the push button, the "knock-off" rod being adjusted so that it will not function. When flash welding the "knock-off" switch is used and must be adjusted to automatically break the circuit at a pre-determined point.

Alloy Welding Processes, Ltd.

The machine illustrated in fig. 2 is claimed to represent a great advance in portable welding equipment, and to embody the very latest developments. The set was ordered by the Crown Agents for the Colonies, and orders for similar sets have been received from the Eastern Bengal Railway, the India Store Depôt, for Rangoon Dockyard and Eastern Bengal Railway, and the Rhodesian Railway. The substantial steel cover, with its wide removable inspection doors at the sides, the protecting doors to the switchboard, the recessed control panel and the flush-mounting switchgear have been well thought out to afford the maximum possible protection under adverse weather conditions. Such refinements as laminated springs, wide steel wheels fitted with roller bearings, and the swivelling forecarriage are points that will be appreciated by those who have to handle such equipment outside the workshops, where the surface over which the equipment is being moved might not be so hard or smooth as may be desired. Each machine is fitted with a special self-stabilising dynamo which has been put through a severe series of trials, and we understand that all those who have tested it praise its performance highly and pronounce it better than the "transformer" type which it supersedes. The risk of breakdown and the maintenance costs are considerably reduced, it is claimed, by the elimination of such devices as series resistances, reactors, transformers, diverter switches, separate exciters, contactors, solenoids, &c.

Holden & Hunt.

Messrs. Holden & Hunt have placed on the market a high speed butt welder, fig. 3, which is claimed to be the latest development of butt welding to cope with high-speed mass production in all classes of mild- and alloy-steels. It is particularly suited for such work as the welding of brake rods, valve stems, and similar classes of work where accuracy and a high tensile strength of weld have to be obtained over large quantities of product with absolute uniformity. The machine is rated at 15 kW. The work is gripped in copper jaws cut out to suit the shape of the job, which are easily interchangeable and are fixed to sliding vice-heads controlled by right- and left-hand vice screws, thus being self-centring. The heads are water-cooled and are accurately mounted on massive slides, ensuring great accuracy of alignment. The high speed of welding is not obtained by increasing the welding voltage, but by using the smallest possible upsetting gap. Instead of an ordinary upsett burr a thin fin is produced which can be very easily removed. Owing to the small volume of heated metal the unit consumption is less than ordinary butt welding. The speed of welding varies from about half a second to 1½ seconds, according to the area of the weld and the class of metal. The welding is effected by a simple stroke of the pedal which automatically performs the sequence of operations to complete the weld. The mechanical pressure device is highly efficient, and it has been found possible to weld many varieties of steel alloys which ordinarily are not considered a practicable welding proposition. The general design has been thoroughly worked out so that in every detail of the mechanical operation no twisting or unbalanced strains are set up. The electrical efficiency is over 90 per cent. and the power factor 0.8. This machine is not a flash welder and does not throw out large quantities of sparks, in fact, in some classes of work it is difficult to see the actual welding.

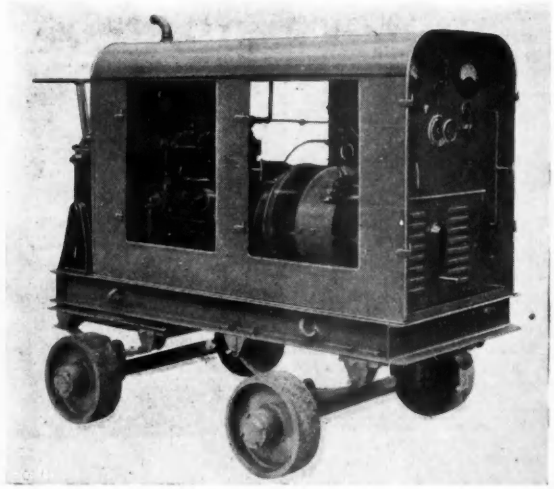


Fig. 2.—"A.W.P." Portable Welding Machine.

The Westminster Engineering Co., Ltd.

This company claims to have been the original manufacturer of welding machines in this country under the Thomson patents, and to have constructed machines of that type for the last 32 years.

Fig. 4 shows a 120-kW butt welder which has been developed by this company for tube work. It is designed to weld a steel bar of 10 sq. in. sectional area, or a steel tube up to 6 in. diam. The time required for this maximum size weld is from 8 to 10 minutes. A 2-in. tube is welded in two minutes, actual time in and out of the machine. Flash welding on lighter sections can also be done, the welds in these cases being practically instantaneous. The parts to be welded are clamped in the jaws of the machine and brought together by means of a powerful hydraulic jack operated by the handle shown in the front of the illustration. A "Westminster" automatic seam welder as used for the mass production of oil drums and such like hollow ware is depicted in fig. 5. Material up to 1/16 in. thick in steel plate making ⅛ in. added thickness can be welded to make oil-tight joints and to stand the corrugating of the plate after welding. The welding speed of two No. 20 S.W.G. steel plates is 4 ft. per minute. The joint to be welded is passed between a pair of rotating water-cooled copper disks forming the electrodes, and these disks, pressing the weld together, close the low-voltage secondary winding of the welding transformer; the welding heat is generated at the contact by the resistance at this point to the passage of the large low-voltage current, which in a 25-kW machine may reach 7,000 or 8,000 A. The "Westminster" patent automatic scaling machine, which, it is claimed, enables the cheapest quality plate to be satisfactorily welded, was described in the Electrical Review of September 6th, 1929, p. 418. It consists of four electrically-driven grinding wheels and a trolley carrying the plate to be scaled. The trolley is operated by reversible mechanism, so that the plate is returned to the starting position after scaling. All four edges are scaled simultaneously, the operation taking about 15 seconds. The cost is only a fraction of that of the older methods. This company also makes the usual range of spot welders, and various special machines for purposes such as concrete-pipe reinforcements, automatic wire welding and many other uses.

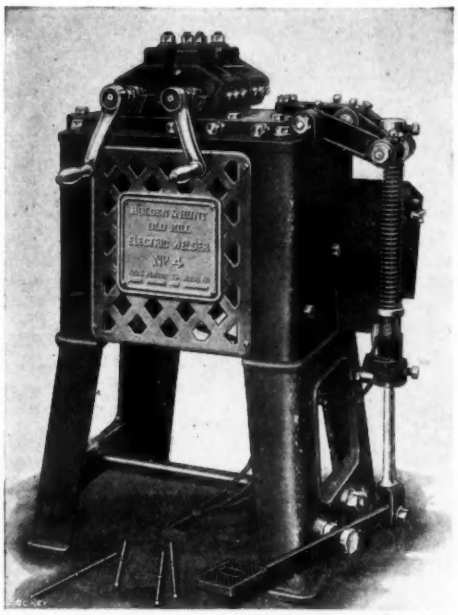


Fig. 3.—"Holden & Hunt" Butt Welder.

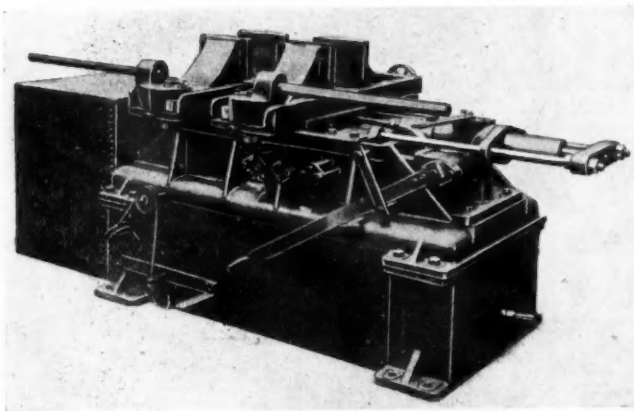
A.C. Welding Company.

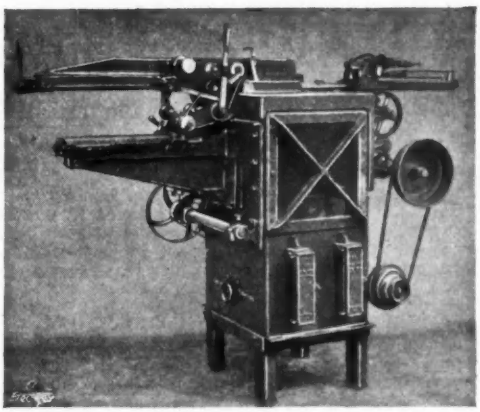
This company claims for its "Alternarc" machine a welding efficiency equal to that of the best d.c. plant, with the higher electrical and other advantages of static transforming apparatus. Fig. 6 shows a standard "Alternarc" machine. The transformer is air-blast cooled, a fan being mounted in the rear of the machine case to provide ventilation. Removable louvres are provided at the forward and rear ends of the case to give free passage to the current of air from the fan. A feature of the machine is the automatic exposed-voltage-limiting device which is only fiteed on those occasions where special conditions of risk render it necessary to reduce the exposed voltage to a maximum value of 30. Where ordinary workshop conditions prevail, this device is not necessary. The device is coupled directly in the electrode holder lead, and it functions in such a manner that, when the arc is "dead," the electrode holder is severed from the main connections of the transformer and coupled *via* the 25- to 30-volt switch operating coil, to a 25- to 30-volt tap on the secondary winding. Contact between the electrode and the work instantly closes the main contacts of the switch, thereby coupling the electrode holder direct to the transformer secondary, the auxiliary 25- to 30-V connection being severed at the same time by the opening of auxiliary contacts. The closing of the main contacts of the switch has by this time completed the main circuit, and the transformer is short-circuited through the electrode and work, and through the series coil of the switch. The switch is consequently retained closed, and an arc can be drawn between the electrode and the work. If too long an arc is drawn, the circuit is broken by the arc failing, and the switch instantly opens, cuts off the main transformer connection, and re-connects the 25- to 30-V tap to the electrode holder, ready for a repetition of the action. From the above it will be seen that this safety device is fully automatic and "fool-proof," the voltage exposed at the electrode holder being limited to a maximum of 30 volts.

Tappings from both the main and auxiliary secondary windings are brought out to plug-in sockets on the front of the machine case, the left-hand set of sockets being coupled to the main secondary, and the right-hand set to the auxiliary secondary. A plug is provided in connection with each set of sockets, movement of the left-hand (or black) plug providing adjustment of the voltage and characteristic curves of the plant to suit the type of wire to be used, while the right-hand (or red) plug affords rough adjustment of the current, according to the size of the electrode and nature of the work. Fine adjustment of the current and also arc-length control are obtained by adjustment of the flux diverter, by means of a handle which protrudes through the top of the case

Haggerty, Lawrance & Co. (Bull Motors, Ltd.).

"Bull" arc-welding sets are of the drooping-voltage characteristic type, the open-circuit pressure being 50 to 70 volts, and the welding voltage 25. The dynamo is reverse compound wound, and the control of the generator is obtained by means of a series field diverter in conjunction with a shunt regulator in the dynamo shunt circuit. Single-operator sets are arranged for driving by petrol engine (for portable work), by d.c. or a.c. motor, and by belt from existing shafting. Two-operator sets are manufactured with a central driving motor direct coupled to two single-operator welding units. Fig. 7 shows the latest type of motor-generator set supplied to the London County Council tramways for the maintenance of tramway tracks. Each machine comprises a generator of 200-A capacity directly coupled, by flexible coupling, to a 10-b.h.p. motor wound for 500 to 625 V d.c. The equipment includes a heavy arc-steadying reactance, excitation by separate exciter, and a complete welding control panel. Two single-pole circuit breakers are fitted on the motor side. The sets are provided with rubber-tired wheels and sprung axles, thereby enabling the machines to be towed behind a motor lorry, or, in the case of short distances, by man haulage. All the machines are





Figs. 4 and 5.—"Westminster" Butt Tube and Seam Drum Welders.

continuously rated. It has been found in practice that the "Bull" standard arc welder is particularly suitable for the

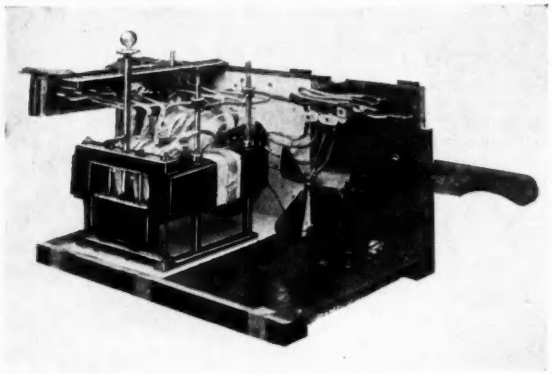


Fig. 6.—"Alternarc" Portable Machine.

welding of light steel sections, owing to the exceptional control of the welding arc. This feature has been further developed,

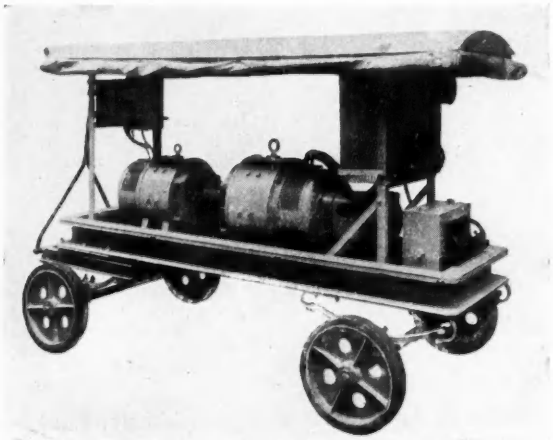


Fig. 7.—"Bull" Machine for Track Maintenance.

with the result that the "Midget" light arc welder, fig. 9, has recently been placed on the market. This set is of 100 A capacity, and is designed for the welding of steel plates from 1/16 in. up to and including ¼ in. in thickness. The machine has an output of 25 to 100 A, with very close regulation. The arrangement of the switchgear is particularly neat, both the starting gear for the motor and the control gear for the generator being mounted in one ironclad cubicle above the machines. The machine is claimed to possess many important advantages, and, in particular, it may be stated that the work is carried out at a high rate of speed, with the consequent reduction in production cost. Distortion and buckling of the plates are largely avoided, thereby improving the quality of the finished article. In addition to the welding of light steel tanks and similar work, the "Midget" machines are largely employed for the manufacture of electrical switchgear cases. These welding machines are used largely in conjunction with "Metal-arc" and "Speedwell" electrodes, the latter type being recommended for new construction work. The welds made have excellent mechanical properties, a particular feature being the freedom from flaws and consequent soundness of the weld.

Scholey Construction Co., Ltd.

The Scholey Construction Co., Ltd., has developed the "Seco" system of arc welding, and specialised on plant for industrial, tramway, and railway practice. Electrically, the machines employed have the characteristics of a compound-wound generator, with the shunt fields connected across the 60-V generator terminals and the series fields in series with the high-voltage winding of the armature. Simplicity is the predominant note of the general design. The switches are mechanically and electrically simple, and they are closed by one movement, and, being interlocking, it is claimed to be impossible for an operator to make a mistake in depressing them. The variable grid resistances mounted also on the switchboard have sixteen steps, the welding current being regulated as desired by simply inserting the plug end of the welding cable into the receptacle on the resistance, which gives the required arc intensity or welding heat. A development of these machines is the dynamotor type, specially suitable for a.c. circuits, but this machine is more than a convertor, in that mechanically and magnetically it has one simple circuit, and yet electrically there are two distinct circuits. It operates as a synchronous motor with a resulting high power factor. In addition to the inherent stable arc of the machines, a suitable stabiliser is provided in the welding circuit, which still further improves the stability of the arc. Owing to the liberal design of the welder and the proper combination of reactance and resistance control, it is claimed that there is no appreciable drop in current after the machine heats up. "Freezing on," breaking of the arc, and other difficulties are reduced to a minimum, because the rush of current at the moment when the arc is established is fully controlled by the arc adjustor, and the machines are so designed that their full capacity may be obtained with either metallic or carbon electrodes. There is incorporated in the welding circuit a low-range current control whereby it is possible to obtain a minimum of 25 amperes, which permits the welding of thin metal sheets down to 1/16 in. in thickness. The machines are supplied either as stationary units or mounted on suitable trucks, fig. 8. The equipment is furnished with the control apparatus on a special panel containing a regulating switch and the necessary meters.

J. H. Holmes & Co., Ltd.

The "Castle" arc-welding equipments form an important part of the manufactures of this company. The machines are manufactured for both d.c. and a.c. work, and they can be supplied complete with an electrode holder, shield, and other

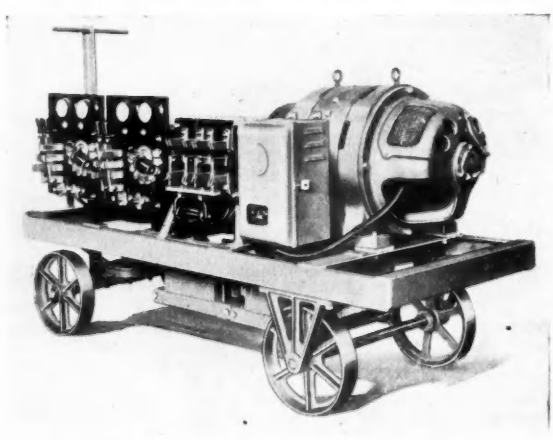


Fig. 8.—"Seco" Arc-welding Machine.

accessories. The standard d.c. equipment consists of a specially designed generator, an adjustable choking coil, and a

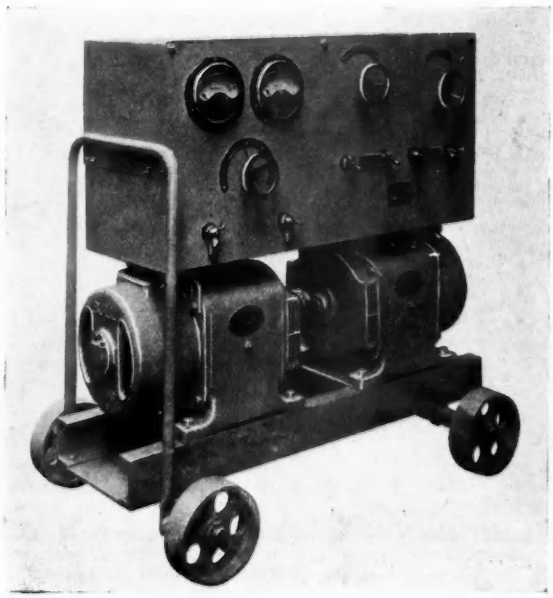


Fig. 9.—Midget Arc Welder; Bull Motors.

control board. The generator may be driven by any form of prime mover, or from a line shaft, a small auxiliary exciting

generator being provided if a d.c. supply is not available. The machines are so designed that, within the limits of their capacity, they can be set to use any make or size of electrode, and to any thickness of metal to be welded. Once adjusted the generator automatically controls the voltage and current of the arc in such a way that the arc is struck with the greatest possible ease, and is maintained at the correct intensity, irrespective of any unevenness in the surface being welded.

A current-limiting device is unnecessary, as the generator is designed to withstand "short-circuits." The full power generated can be transmitted to the arc and used for making the weld, there being no intermediate resistances. The adjustable choke coil prevents the electrode sticking to the work when contact is first made, and this enables the operator to strike and draw the arc immediately, without jerking, thereby enabling a weld of uniform penetration to be made from start to finish. The standard a.c. equipment consists of a single-phase static transformer and a specially constructed current regulator. Special care has been taken to prevent cooling of the arc as the current changes from one half-cycle to the other, and a non-spluttering arc relatively easy to control is ensured, thereby enabling satisfactory welds to be made, and a good degree of penetration to be obtained. The machines are metal-clad and showerproof, and are therefore suitable for use either indoors or out of doors. They can also be made either portable, by mounting them on wheels, fig. 10, or semi-portable, with provision for slinging from a crane. There is a notable absence of trailing leads, and the whole set is very compact. The standard output is 200 A for plates up to 1 in. thick, but larger or smaller sets are made for specially heavy or light work.

A-I Electric Welding Appliances Co.

Fig. 11 shows a hydraulically-operated automatic butt welder developed by this company for the purpose of welding smoke tubes, superheater tubes, flanges to pipes, &c. By this method the tubes are cut to length and the flange is turned with a short spigot of similar diameter and thickness to the pipe and then automatically butt welded. Once the pipe and flange are clamped in position, the entire operation of welding is automatic. The machine covers a wide range of sizes of pipes, &c., and settings for different bores of pipes are easily obtained by means of indicators fitted on the machine. It has been found that superheater tubes welded by this method can withstand pressures up to 1,500 lb. per sq. in. and temperatures up to 800 deg. F. A steel tube 6¼ in. in diameter, with a wall thickness of 5/16 in., can be welded to a flange having a projecting spigot of equal section on one face for a consumption of 1 kWh, the welding time not exceeding 1 minute. Considerable saving has been made

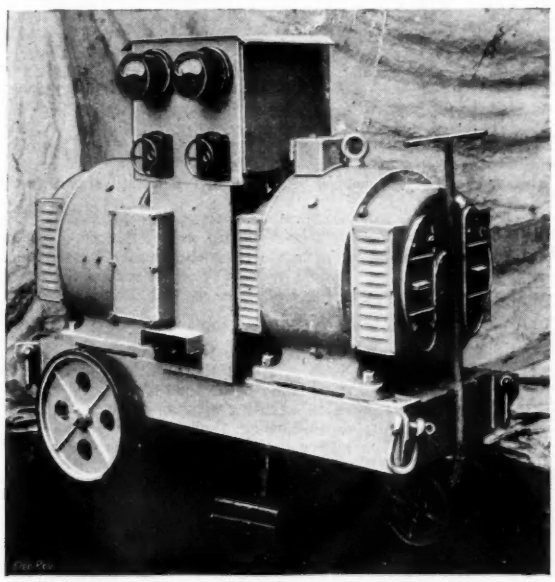


Fig. 10.—"Castle" Arc Welding Set.

by railway companies by re-ending smoke tubes and welding superheater tubes and buffer end bars by this method. The London and North-Eastern Railway Co. has under steam pressure 300,000 smoke-box tubes that have been re-ended by the butt-welding process. In operation the two parts to be welded are clamped in the heads of the machine by moving two levers controlling the two hydraulic clamping cylinders on the heads of the machine. The main hydraulic valve on the machine is then opened by the movement of a third lever, which simultaneously switches on the current to the transformer. The automatic control comes into operation at this point and allows the head carrying the one unit to be welded to approach the other unit at a speed which ensures that the metal in contact is being "flashed" away as fast as the heads approach each other. This maintains a light contact at the ends of the metal, with the result that the electrical resistance at this point is kept high and a maximum

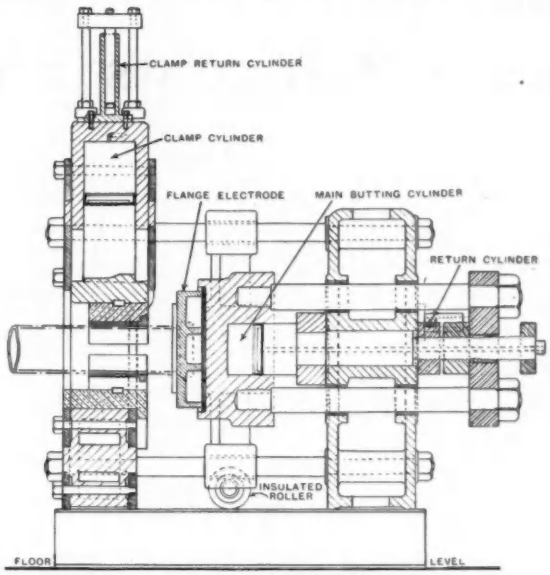


Fig. 11.—"A-I" Automatic Butt Welder.

heating effect is obtained at the joint. This operation continues until the extreme edges of the metal are raised to a welding temperature, when the current is automatically switched off and a heavy forging pressure, according to the section being welded, is rapidly applied to the weld. This completes the forging process, at the same time ensuring a joint of homogeneous section by forcing out any impurities from the weld, and increasing the density of the metal and the strength of the weld. The machine illustrated is capable of dealing with a wide range of work, and is suitable for welding steel flanges to steel tubes from 1 1/16 in. external diameter up to 6¼ in. external diameter, and of 6 sq. in. sectional area. It is fitted with a special detensifier, which enables the correct butting pressure to be applied to the section, three pressures being available to suit the particular size of pipe being welded. The machines may be operated on any a.c. commercial voltage, and with a hydraulic supply of from 1,000 to 2,240 lb. per sq. in.

(To be concluded.)

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Conductivity of Metal Casing.

Would any of the readers of your valuable paper say what methods they have found most satisfactory for testing the conductivity to earth of metal sheathing or tubing, including joints and bonds, on consumers' premises? If an instrument is used which passes no current through the circuit under test, there can be no proof that the bonds are strong enough to carry an earth current, even though the resistance is low enough to satisfy the requirements of the Board of Trade, and I should, therefore, be grateful to learn other peoples' views on this subject.

Grampian.

October 7th, 1930.

Costs of Crop Damage.

The article under the above heading in your issue of September 19th, 1930, is of considerable interest to wayleave officers and others concerned with the erection of overhead transmission lines across agricultural country, and who have to deal with claims received from the agricultural community for crop damage.

In my opinion, however, the second paragraph of the article clearly demonstrates the futility of averages (*i.e.*, curves) for crop costing purposes. It reads:

> "Neighbouring farmers will make widely divergent claims for similar damage to crops of similar nature that can be reckoned to cause considerable worry to anyone who is trying to assess or estimate the cost of damages . . . ."

If the "anyone" referred to be someone untrained in the science of agricultural valuation, this may be correct. But, generally speaking, the reason "claims for similar damage to similar crops" are "widely divergent" is not necessarily because they are put forward by individual farmers with "widely

divergent" ideas (or hopes?) on the subject of crop values (as the writer apparently presumes), but rather because two "crops of a similar nature" can, and often do, have "widely divergent" values.

I have recently had to deal with two cases of damage done to sugar-beet crops by contractors erecting an overhead line. The one crop is clean with a percentage of sugar of probably 22. The other crop is full of tedge and chick-daisy, and, although the roots themselves may not look inferior to the uninitiated, the sun has never got at them properly and the sugar percentage will probably be down to 14 per cent. The gross values of the crops would be about £40 per acre in the first instance and £10 per acre in the second. In other words, 'similar damage to crops of a similar nature" may easily be as "widely divergent" as four to one.

I could give endless examples of a similar nature met with in cases of damage to root and cereal crops in every day practice. I can only add that anyone going about assessing such damage with the aid of a chart based on averages will, I imagine from a fairly wide experience—

(1) "do" the farmer in some instances and his employers in many others;
(2) involve himself and his employers in some expensive arbitrations;
(3) make himself and his employers thoroughly unpopular at the outset with a community with whom they have to live for ever after.

The concluding paragraph reads:

"with such a set of curves as is shown in figs. 1 and 2 and the latest market prices . . . costing of crop damages . . . becomes a simple and definite operation."

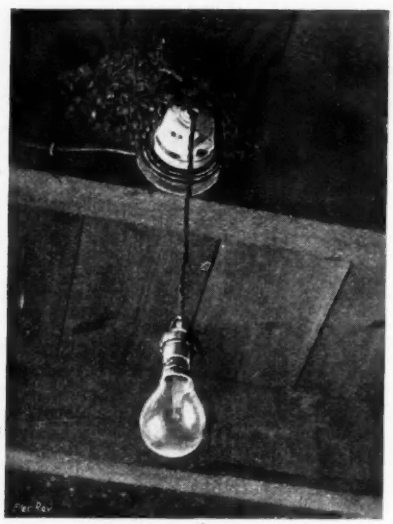
Such a statement, if accepted, would almost make one regret the years of study (to say nothing of the hundreds of pounds expended during the long period of training) necessary to pass institute examinations in agricultural valuation work.

Chief Wayleave Officer,
Associate of the Surveyors' Institute.

October 6th, 1930.

"A Case of Bird-nesting."

Swallows have for many years built their nest on the ceiling rose shown in the illustration, which is used for a stable light,



and, although the nest was taken down, they insisted on building a new one the following year. I send this thinking it may prove amusing to your readers.

H. M. Houlson.

Penzance, *October 7th*, 1930.

Phasing Out E.h.p. Cable Joints.

I was drawn into an interesting discussion with two of my friends on the necessity of phasing out when jointing e.h.p. 3-core paper cables; both agreed that they ignored the phase colouring on the cores and aimed at getting the core ends which were opposite each other connected together, leaving the question of phasing out to the final connections at the end of the run. They insisted that this also applied to large l.p. cables, as conductors were now of such a size that it was impossible to twist them into position at the joints.

My contention was that it is essential that the cores should be twisted to connect correct colours. There need be no difficulty in this, as by the careful use of a short bar the cores can be forced round into the correct position for marrying colour to colour. This treatment may result in a slight cracking or opening up of the paper insulation on the cores, but this surely is not a serious matter, considering that the joint is finally surrounded with a high-grade insulating compound.

I take it that the cable manufacturers place coloured papers on the cores so that any phase may be traced out in the case of a fault, and therefore it seems to me that colours should be continuous throughout.

As I may be wrong on this question, I should be glad if some of your readers would give us their views.

Foreman Jointer.

October 13th, 1930.

The French Market for Electrical Accessories.

I was pleased to learn through the medium of the Electrical Review (September 26th, 1930, p. 498) that someone—the Department of Overseas Trade—has discovered that there is a market in France for some electrical goods. I am afraid that too often of late years we have been inclined to neglect and regard some of the Continental markets as hopeless, possibly because of price and also the tariff imposed on imported manufactures.

I am prepared to admit that France manufactures many of her requirements, which are produced cheaper than in England owing to lower labour costs and, therefore, in the majority of cases we can hardly expect her to pay a higher price for the same goods just for the sake of "Buying British." But we ought not to lose sight of the fact that in this country we manufacture some goods which are not produced in France, and here is our chance of doing business. The question then arises: How are we to know what she wants, or what we make and she doesn't? The answer is obviously—go there and find out!

Quite recently I accepted an invitation to go to France for a week to help and advise a small engineering firm on sales matters. I thus had an opportunity of gaining experience of present-day French business methods, and at the same time obtaining a little money. The principal of the business, with whom I spent most of the time, was a very keen student of commerce, and I discussed with him the subject of protective duties. He informed me that if they required a particular thing in France they would have it, duty or no duty, and he mentioned a number of things that were not made in France and which had to be imported from abroad. I believe this to be true because I have in my possession a catalogue in French, issued by an English firm, which illustrates a number of such things.

At the time of writing I have not seen a copy of the D.O.T.'s report, but from my own observations, particularly on this last occasion, I should think there would be a market for various electrical accessories in France. Whatever firms decide to act, it is to be hoped that they will not expect to set the Seine on fire during the first month. Above all, send out a salesman who is a business man, one who will get to know his customer and study him; not just a linguist. Give the salesman a chance and remember that travel is as expensive in France as in England; don't expect him to be successful on a commission basis. Have all pamphlets and communications written in French. This is not a difficult matter and should not involve big expense.

It is to be hoped that some firms will not be afraid to spend a little money on exploring the possibilities of this suggested market and thus assist the recovery of our dwindling exports.

Detached.

[A special article on the French market for domestic electrical products will be found elsewhere in this issue.—Eds. Elec. Rev.]

Tariff Rates for Industrial Purposes.

Throughout the country we are doing our best to introduce large electric baking ovens, and success or otherwise depends upon obtaining a favourable rate for electricity. It is well known that the rates existing are very diverse, but we are at a loss to understand why there should be so much difference among the larger supply authorities in the London area.

We appreciate that the engineers and managers know their own business better than it is possible for us to expect to know it, but the following is an example of what we are up against. We obtained the order for a large electric oven to be installed on the mains of the Hackney electricity undertaking. We are given the very favourable rate of ½d. per kWh from 7 p.m. to 7 a.m., and ¾d. per kWh from 7 a.m. to 7 p.m. This renders electric baking a commercial proposition.

A little further out we endeavoured to obtain a similar rate in West Ham. We find that we are compelled to inform the client that the first 40 kWh per h.p. installed per quarter are chargeable at 3d. per kWh, and all over and above at ¾d. per kWh. As a 45-kW oven was considered, we are advised that the rate would work out to a round figure of 0.88d. per kWh, which, of course, rules out the baking proposition entirely.

We agree that other districts charge much higher rates, but when it comes to these large areas around London, we certainly consider that it is time a uniform rate is instituted.

Artofex Engineering Works, Ltd.,
W. Ellerd-Styles, M.I.E.E.,
Managing Director.

October 10th, 1930.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The E.D.A.-E.L.M.A. Campaign.

Concurrently with the London luncheon inaugurating the E.D.A.-E.L.M.A. Shop and Display Lighting Campaign, which was reported in our last issue, similar functions were held in many provincial centres.

The Travelling Exhibition of Electric Signs.

At Liverpool the chair was occupied by Councillor F. C. Wilson, who gave some particulars of the campaign, while Mr. F. J. Marquis, managing director of Messrs. Lewis's, the departmental store owners, also spoke.

Mr. J. Douglas Green presided at the Leeds luncheon and an address was delivered by Mr. D. Pearson, secretary of the local Circle. The chairman of the Glasgow luncheon was Major H. Bell, the city electrical engineer, the principal speaker being Sir Robert Wilson. The address at the Nottingham luncheon was given by the chairman of the local Circle, Mr. G. H. Lake, city electrical engineer, and that at Bradford by Alderman J. W. Longley, chairman of the Bradford Circle. Mr. Desmond Pearson, hon. secretary of the Leeds Circle, delivered the address at the Leeds luncheon. At Torquay the chairman was Mr. F. Callard, chairman of the Electricity Committee, and Mr. H. Lingard was the speaker.

Mr. H. S. Ellis, chairman of the West Gloucestershire Circle, presided at the luncheon at Gloucester organised by the Circle, and the address was delivered by Councillor H. Harmer, chairman of the Gloucester Electricity Committee.

The official progress report issued by the E.D.A. states that in addition to the above-mentioned luncheons similar events were to be held in Gloucester, Bristol, Cheltenham, and Manchester this week. Additional lectures and demonstrations have been arranged in the provinces and at the E.L.M.A. Lighting Service Bureau, London, and shop-lighting competitions have been organised in Bath, Swansea, and Bingley, bringing the total up to 21. At Cheltenham, about 120 entries were received in the local lighting competition. Mr. T. Catten, of the London Lighting Service Bureau, acted as judge. In the Birmingham area five shop premises have been retained for trial installations. Up to the date of the report 2,500 inquiries for special information had been received from shopkeepers in all parts of the country. Mention is made of the travelling exhibition of electric signs organised by the Master Sign Makers' Association in conjunction with the E.D.A. and a list of about 50 towns which have been, or are being, visited is given. This display is depicted in the accompanying illustration.

We have already reported that 600,000 retailers in Great Britain are being informed individually of the aims and objects of the Campaign. They are invited to ask for further information and those who respond to this invitation are to receive a booklet (E.D.A. 882) in which the whole subject of shop lighting is dealt with succinctly and pictorially. Various patterns of shop-window reflectors, floodlights, &c., are illustrated and their correct use explained. The employment of colour lighting is dealt with and advanced illumination is depicted in a number of views of actual installations. We consider that the booklet cannot fail to impress the shopkeeper with the immense scope for illumination, its economic value to him, and its aesthetic worth.

With a view to giving traders the opportunity to demonstrate the latest appliances for shop-window lighting and electric signs for shop facias, Southport Corporation Electricity Committee has decided to co-operate with the Chamber of Trade in organising a special week of electrically-illuminated shop windows in November.

Grocery Store Illumination.

An interesting scheme of illumination has recently been completed at Messrs. Hammett's grocery store at Chiswick by the General Electric Co., Ltd. The window display has been made additionally attractive by the use of "Gecoray" reflectors, whilst the interior of the store is brilliantly lighted by means of "Britalux" units equipped with "Osram" lamps. An excellent impression of the interior illumination can be obtained from the accompanying illustration.

G.E.C. Lighting Fittings in a Store.

Registered Electrical Contractors.

Applications from the following for registration were accepted by the executive committee of the National Register of Electrical Installation Contractors at its last meeting:—Lancelot E. Hendry, Grimsby; Ffrangcon Auto Co., Ltd., Bethesda; T. Twist & Sons, Earlestown, Lancs.; David Rowan (Vidre), Ltd., Liverpool; Ames & Willmar, Chichester; A. G. Slade, Liverpool; W. B. Simms, Sandwich; J. H. Beard, Stalybridge; H. Norman Kirk, Ltd., Swansea; Alpha Manufacturing and Electrical Co., Ltd., Balham, S.W.12; Eric Smith & Co., Aston, Birmingham; Sydney R. Hare & Son, Ltd., Birmingham; and Davis & Millward, Birmingham. At the same meeting eight applications were declined.

The British Engineers' Association.

At yesterday's monthly luncheon of this Association the retiring president, Sir Gilbert C. Vyle, was to deliver an address on "Current Affairs."

French Foreign Electrical Trade.

The official returns relating to French imports and exports during the first half of the current year have recently been issued. They show that the imports of electrical machinery and apparatus into France during that period attained a value of £3,124,904, as compared with £2,362,112 in the corresponding half of 1929. The exports of similar goods of French manufacture advanced during the same period from £1,712,632 to £2,185,266.

New French Companies.

Among the companies recently organised in France are the Société Voltsampère, Paris (3, Rue Malher), capital £96,000, to manufacture accumulators and electrical apparatus; La Compagnie des Tubes Luminescent et de Fabrication d'Appareils Electriques à Gaz Rares, Paris (35, Rue Beaubourg), £20,800, to manufacture fluorescent apparatus; and La Société Française Cataphotes et Soleclair, Paris (9, Rue du Commandant Marchand), £16,000, to manufacture luminous signs and signalling apparatus.

Tube Manufacturers' Agreement.

Messrs. Stewarts & Lloyds, Ltd., and Tube Investments, Ltd., have concluded an agreement by which they will establish close co-operation in research and technical work, eliminating costly duplication and overlapping. Each company is to create a small number of "liaison" ordinary shares for which the other company will subscribe.

Tube Investments, Ltd., holds all the capital of Simplex Conduits, Ltd., and the Credenda Conduits Co., Ltd., among other companies, and a controlling interest in the Metallic Seamless Tube Co., Ltd.

New Municipal Showrooms and Offices.

New showrooms were opened on October 10th by the Wakefield City Electricity Department, at Angel Chambers, Wood Street. The opening coincided with the national shop-lighting campaign, and in addition to appliances for domestic uses the department is featuring shop fitments and the offer of electricity at 2d. per kWh as a special advertising rate for lighting after shop hours.

Stockton.—The Town Council has agreed to borrow £5,000 for the purchase and equipment of premises in Bishopton Lane for the purposes of a showroom, offices, &c., in connection with the electricity undertaking.

Dewsbury Town Council has approved the taking of premises at 23, Market Place for electrical showrooms and offices, at an estimated cost of £150 for conversion to showrooms and £220 for offices.

Our Overseas Electrical Trade.

During September the value of electrical goods and apparatus exported from the United Kingdom was £1,349,372, an increase of £598,212 as compared with August last and one of £451,380 as compared with the corresponding month of last year. Electrical machinery exports were valued at £398,528, a decrease of £95,909 from the August figure and £34,020 lower than in September, 1929.

As regards imports, electrical goods and apparatus amounted to £571,391, a decrease of £29,494 as compared with August and one of £73,673 as compared with September, 1929. Electrical machinery imports at £111,147, were £8,816 lower than in August and £26,720 lower than in September last year.

Installation Work at Nottingham.

At last week's meeting of the Nottingham City Council questions were asked regarding installation work carried out by the Electricity Department, and in reply to them the vice-chairman of the Electricity Committee (Alderman W. Halls) said that under the assisted wiring scheme 94 men were employed and the number would be doubled in the next few months. The Department had had a conference with the local contractors but he was not aware that any further communications had been received from them. It was not true that while the Department used "Maconite" cable it required private contractors to use wiring enclosed in steel tubing. The men employed were paid the standard rate of wages but were not guaranteed a full week. Under certain conditions they were paid for holidays. Private contractors were required to make a deposit of £4 before proceeding with the work. The provisions of Clause 48 of the Electricity (Supply) Act, 1926, with regard to the keeping of separate accounts for the installation department, were being complied with.

In reply to a suggestion that his reply was inaccurate, Alderman Halls said that it was based on information obtained in conjunction with the engineer.

A Municipal Electrical Magazine.

The chief engineer and manager of the Worksop U.D.C. Electricity Department (Mr. M. S. Mason) has sent us a copy of the new "Worksop U.D.C. Electrical Magazine" which is to act as a link between the Department and its consumers and aims at teaching the latter how to get the best out of their installations. The first number contains the commencement of an illustrated article upon the local undertaking, notes on meter reading, advice on the purchase of apparatus, and other interesting matter.

Proposed Showrooms at Bath.

The Bath Corporation Electricity Committee recommends the Council to submit to the Unemployment Grants Committee a scheme for the erection of new electrical showrooms and offices at a cost of £24,000.

Market for Wireless Apparatus in Malaya.

A confidential report on the market for wireless apparatus in Malaya has been prepared by the Department of Overseas Trade from information furnished by His Majesty's Trade Commissioner at Singapore and issued to firms whose names are entered on its special register. United Kingdom firms desirous of receiving a copy of this report together with particulars of the special register service of information and form of application for registration should communicate with the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Reference number B.X. 6799 should be quoted.

A Large Railway Contract.

In our last issue we reported that the Southern Railway had placed an important order with the Metropolitan-Vickers Electrical Co., Ltd., for electrical equipment for the rolling stock on the Brighton section of the railway which is in course of electrification. At the same time the railway company awarded the British Thomson-Houston Co., Ltd., an order for equipment to about the same value—£250,000.

Italian Foreign Electrical Trade.

The imports of electrical machinery and apparatus into Italy during the six months ended with June last attained a value of £2,075,460, as compared with £1,944,900 in the first half of 1929. The exports of similar material from Italy during the same period declined from £503,970 to £483,130.

New Argentine Companies.

The *Review of the River Plate* records the formation of the following companies in Buenos Aires:—Radio Buenos Aires, capital $50,000 paper, for broadcasting and providing apparatus; Protos S.A. Electricidad en el Hogar, capital $100,000 paper, to deal in electrical articles for domestic use; and the Compañia Constructora de Telegrafos y Telefonos, capital $1,000,000 paper, to construct telegraph and telephone systems.

Hull Electricity Department and Local Contractors.

At a recent meeting of the Hull Corporation Electricity Committee the engineer reported that he had met representatives of the Electrical Contractors' Association with regard to the sale of fittings and had agreed to the following:—In the case of direct sales: Subject to the contractors on the approved roll agreeing to purchase the whole of their requirements in fittings and current-consuming domestic appliances from the Department's showrooms, full trade discount should be allowed, the Department retaining the factors' discount only. In the case of hire-purchase sales: Where the customer was introduced directly by the contractor an allowance of 10 per cent. on the retail price should be given to the introducing contractor. The action of the engineer was approved.

The Syrian Market.

A recent Department of Overseas Trade report upon economic ditions in Syria by Mr. R. Eldon Ellison, Acting Consul-General at Beirut (Stationery Office, 1s. net) indicates that the market for electrical goods is a small one. In 1929 1,111,821 kg. (about 111 tons) of electrical machinery was imported into the country. The report mentions that electricity is now supplied to the better quarters of Aleppo. A tramway system was opened in January last year but it has so far proved a failure. The same company has started work on the harnessing of the Daphne Falls, which is expected to prove a valuable source of electric power. British goods enjoy a high reputation as regards quality, but price is the ruling factor in Syria, and it is considered that British firms are less willing than their competitors to meet the special needs of a small local market in minor points. Business is usually done through commission agents who need careful choosing owing to the low standard of commercial morality in Syria.

Unemployment.

There was an increase of 52,031 in the number of registered unemployed during the week ended September 29th. The total at that date was 2,161,689, as compared with 2,109,658 on September 22nd, and 1,181,862 on September 30th, 1929. It is estimated that at September 22nd, 1930, there were approximately 9,642,600 insured persons, aged 16 to 64, in employment in Great Britain. This was 50,800 fewer than a month before and 661,400 fewer than a year before.

Plymouth and Spare Time Employment.

At a recent meeting of the Plymouth Electricity Committee, the chairman and vice-chairman reported with regard to their inquiries in connection with employés undertaking and being remunerated for duties in addition to those performed for the undertaking and it was decided that the employés under the control of the Committee should be notified that the acceptance or continuance of an agency by an employé for the supply of any material or performance of any service in connection with electrical work or street lighting would not be permitted, and further that the offer to an employé of any such agency must be reported to the electrical engineer.

Czecho-Slovakian Electrical Imports.

The *Board of Trade Journal* states that during August last the imports of electrical machinery and apparatus into Czecho-Slovakia were valued at 21 million crowns (£128,000) raising the total for the first eight months of the year to 197 million cr. (£1,200,000).

Bankruptcy Proceedings.

G. E. SPERO, lately carrying on business at 121-123, Rosebery Avenue, E.C., as the "Truphonic Wireless Co.," physician-surgeon and manufacturer of wireless apparatus.—A sitting of the London Bankruptcy Court was held on October 7th before Mr. Registrar Stiebel for the public examination of this debtor, against whose estate a receiving order was made on July 24th upon the petition of the liquidator of Fleetwood, Fowden, Simpson & Co., Ltd., creditors for £1,571. Mr. V. Armstrong, Assistant Official Receiver, reported that the debtor had not attended under the proceedings and was believed to be in America; communications sent to him at an address in New York had not been acknowledged. The examination was adjourned *sine die*.

E. W. WOOD, electrical engineer, 69b, Kettering Road, Northampton.—The public examination herein was held at the County Hall, Northampton, recently. The statement of affairs showed ranking liabilities of £284, against assets of £15, leaving a deficiency of £269. The debtor attributed his failure to "bad debts, loss on a motor car, and loss by fire." The examination was adjourned, in order that the debtor might submit an amended deficiency account.

W. ADAMS (Electrovacs), electrical engineer, 120, Victoria Street, S.W.1.—Receiving order made October 6th on a creditor's petition. First meeting, October 17th, and public examination November 26th, both at Bankruptcy Buildings, Carey Street, W.C.2.

E. E. PEACE (Peace & Co.), manufacturing electrical engineer, 20, Highland Road, Erdington, Birmingham.—Trustee: Mr. C. Hoult, 191, Corporation Street, Birmingham, Official Receiver, released September 17th.

V. H. BATES (The Linton Radio Service), wireless engineer, High Street, Linton.—Trustee: Mr. F. H. Langmaid, 41, Sidney Street, Cambridge, Official Receiver, released September 22nd.

Private Arrangements.

J. VEITCH, electrical engineer, Royal Bank Buildings, Gardiner Street, Prestwick.—A meeting of creditors was held recently, when a statement of affairs was submitted which disclosed liabilities of £647 of which £397 was due to trade creditors, and the balance was in respect of a bank overdraft. The net assets were £88, leaving a deficiency of £589. The estate showed an apparent dividend of 2s. 8d. in the £ subject to contingencies and realisation. The debtor had no offer to make, and it was resolved that the estate should be realised under a trust deed in favour of Mr. McAuslan, Ayr, as trustee. A committee of inspection was also appointed.

E. G. F. BROWN, trading as Brown & Jepson, electrical engineer, 6, Alexander Street, Airdrie.—At a recent meeting of creditors a statement of affairs was submitted showing liabilities of £1,154, of which £899 was due to the trade and £255 to the bank. The net assets were £502, leaving a deficiency of £652. The estate showed approximately 8s. 8d. in the £. The business was commenced in 1918 by the debtor, in partnership. The latter was dissolved in 1927 and the debtor had since traded alone. During the year to March 31st, 1926, the turnover was £4,444, but in the three following years it declined, although during the 12 months to March 31st last it amounted to £3,103. The position was attributed partly to losses sustained on contracts. In the absence of an offer it was decided that the estate should be dealt with under a trust deed already executed.

A. R. AVENT, trading as the Spa Radio Stores, 16, Clarence Street, Cheltenham.—A meeting of creditors interested herein was held recently at Cheltenham, when a statement of affairs was submitted which disclosed liabilities of £2,549, all due to unsecured creditors, and net assets of £1,387. It was reported that the debtor at one time carried on business at Clarence Street, Cheltenham, and he later opened branches at Worcester, Gloucester, Bristol, and also another shop at Cheltenham. During the last twelve months he had lost a considerable amount of money on those branches, and was urged to close them down. In July last a fire occurred at the Worcester premises and a considerable amount of money was lost. It was decided that the debtor should be requested to execute a deed of assignment in favour of Mr. F. E. Bendall, of Messrs. Poppleton, Appleby and Hawkins, and Mr. Marcus Hazlewood, of Cheltenham, as joint trustees.

Company Liquidation.

UNIPRESSURE, LTD., Jersey.—A meeting of members will be held at 701, Salisbury House, London Wall, E.C.2, on November 25th, to receive an account of the winding-up of the company by the liquidator, Mr. J. Stocker.

Meeting of Creditors.

JOHN KING, LTD.—A meeting of creditors was held on October 13th at the Law Association Rooms, 14, Cook Street, Liverpool.

Winding-up Petition.

ASSOCIATED WIRELESS CO., LTD.—A petition for the winding up of this company has been presented to the High Court by Tungsram Electric Lamp Works (Great Britain), Ltd., and will be heard in London on October 20th.

Recent Contracts.

Under this heading in our last issue we made mention of a large contract awarded to Messrs. CLARKE, CHAPMAN & CO., LTD., by the Newcastle-on-Tyne Electric Supply Co., Ltd. Messrs. Clarke, Chapman have now sent us some details of this contract from which it appears that the installation will consist of twelve water-tube boilers of which four are to be powdered-fuel fired. The total evaporation of these boilers is 1,686,000 lb. of water per hour. Messrs. Clarke, Chapman are responsible for erecting six of these boilers and Messrs. BABCOCK & WILCOX, LTD., the remainder. Messrs. Clarke, Chapman have also secured the contract for the whole of the powdered-fuel milling plant. All the boilers are to have extra large combustion chambers which will be protected by patent water-cooled walls of the "Bailey-Babcock" type, thereby reducing the maintenance costs of refractories. The boilers will also have special forged steel drums suitable for the pressure of 625 lb. per sq. in. and the plant will embody all the latest improvements in boiler design and automatic controls. The powdered-fuel plant will consist of eight "Resolutor" pulverisers each being capable of pulverising five tons of coal per hour. This plant will be complète with driving motors, fans and separators, together with the company's patent ring-main system of fuel distribution. The first two units are to be completed by July 1st, 1932, and the remainder by September 1st, 1932.

MESSRS. W. CROCKATT & SONS, LTD., inform us that they have recently received a repeat order for two patent electric salinometer outfits for the East London power station from the Brush Electrical Engineering Co., Ltd. Each outfit consists of an indicating and recording instrument mounted on a planished steel switchboard, together with change-over switches, warning lamp, &c. They have also received recently orders for British ships, and for commercial work, two of the latter being for power stations abroad, one in Portugal and the other in Persia.

The ENGLISH ELECTRIC CO., LTD., has recently received orders for "Fullagar" opposed-piston oil engine sets, valued at £92,000. The contracts comprise:—Karachi Electric Supply Corporation: 1,500-b.h.p. engine and tandem generators; the Admiralty: two 1,125-b.h.p. engines and 750-kW d.c. generators; Delhi Electric Supply Co.: 1,125-b.h.p. engine and 750-kW a.c. generator; Dubbo (Australia): 750-b.h.p. engine and 500-kW a.c. generator; Zanzibar (Crown Agents for the Colonies): a 750-b.h.p. unit.

Earlier in the year orders were received for "Fullagar" engine sets from the Sudan Light and Power Company, 1,125-b.h.p. engine and alternator, and the Bermuda Electric Light, Power and Traction Co., Ltd., 1,500-b.h.p. engine and alternator.

NEWALL'S INSULATION CO., LTD., states that a prominent North-East Coast firm has placed an order for sufficient of the company's 85 per cent. magnesia heat insulation to cover 150 miles of steam piping. A further order from Canada calls for the supply of 22 miles of pipe insulation to be used on one plant in the Dominion. The two orders will absorb 10,000 tons of raw material.

Trade Announcements.

We are informed by the "MYCALEX" (PARENT) CO., LTD., Abbey House, Victoria Street, S.W.1, that "Mycalex" (a new insulating material) is now being handled in Paris by Quartz et Silice (the subsidiary company of the Société Gobain), which has the exclusive rights for France. A contract has also

been entered into with the Westinghouse Electric and Manufacting Company, Pittsburgh, U.S.A., for its manufacture and sale in the United States of America, where the General Electric Company of America has been manufacturing "Mycalex" for its own uses for a considerable time.

Messrs. E. P. Allam & Co., Ltd., 107/109, Gray's Inn Road, W.C.1, state that their telephone numbers have been altered to Holborn 5848/9.

An agreement has been concluded between Creed & Co., Croydon, and the Morkrum Kleinschmidt Corporation, United States, whereby the former company will represent the Morkrum Kleinschmidt Corporation throughout the world, excluding America, American possessions, Canada, and Newfoundland. In addition to its own extensive range of patents covering teleprinters and all types of telegraph apparatus, the Creed Company has secured rights under the valuable patents owned by the American company.

The Leicester branch of the Edison Swan Electric Co., Ltd., recently experienced a disastrous fire at 38, High Street. As the whole of the lists and catalogues were destroyed, trade friends are asked to send their latest catalogues and discount sheets.

The British Ebonite Co., Ltd., announces that Mr. L. Lewin, of Manchester, has been appointed representative of the company for the sale of "Becol" products in the counties of Lancashire, Yorkshire, and Cheshire.

The Scott Machine Tool Co., Keighley, has opened new showrooms and offices at 67, Pellon Lane, Halifax, and it states that it can now supply all the range of machine tools formerly built by Scott Bros. (Halifax), Ltd.

The Chloride Electrical Storage Co., Ltd., announces that the telephone number of its "Exide" battery depôt at 219, Shaftesbury Avenue, W.C.2, has been changed to Temple Bar 5454.

Local Exhibitions.

Wandsworth.—With a view to popularising the use of electricity for domestic purposes, the County of London Electric Supply Co., Ltd., held an exhibition of electrical appliances last week at the Wandsworth Town Hall. The exhibition was opened on Tuesday by Councillor J. T. Cox, J.P., the Mayor of Wandsworth, and attracted large attendances. In addition to the bureau of the organisers where information and literature were available regarding all questions of supply, wiring, service and domestic and other appliances within the company's area, stands displaying a wide range of all types of domestic electrical apparatus were occupied by several well-known companies. These included Messrs. Belling & Co.; Berry's Electric (1928), Ltd.; the Electric Lamp Manufacturers' Association of Great Britain, Ltd.; the General Electric Co., Ltd.; Hoover, Ltd.; Revo Electric Co., Ltd.; Rotapex, Ltd.; and Sadia, Ltd. Demonstrations were given of the "Radiovisor" invisible ray, burglar alarm, automatic street-lighting apparatus, &c., and much attention was attracted in one of the side halls by "Eric the Robot," an electro-mechanical man who can make a speech, gesticulate, flash his eyes, breathe forth sparks, and answer questions put by members of the audience.

Hartlepool.—Under the auspices of the Hartlepool Corporation and the Cleveland & Durham Power Co. an electrical exhibition has been organised in the Borough Hall, and was formally opened by the Mayor. The exhibition is well equipped with electrical apparatus and an all-electric café has been arranged by the Hartlepools branch of the Women's Electrical Association. The exhibition closes to-morrow (Saturday).

New Catalogues and Lists.

G. & J. Weir, Ltd., Cathcart, Glasgow.—Revised catalogue, section 1, dealing with feed pumps, feed heaters, &c., for marine work and also a booklet containing examples of "Weir" high-pressure boiler feed pumps.

The Manor Electric Oven & Fire Co., 7, Sutton Street, Charing Cross Road, London, W.1.—Catalogue No. 28, giving particulars of electric cookers, fires, ovens, hot cupboards, wash boilers, water heaters, kettles, boiling plates, &c.

The T.B.T. Electric Co., Ltd., 171, Queen Victoria Street, London, E.C.4.—A priced catalogue (RVTS 39/30) of a.c. motors and a leaflet illustrating a new electric grinding machine.

The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—The September issue of the "Osram Bulletin" containing interesting articles on the lighting of the Strand Palace Hotel, tramcar and shop-window lighting and "Magnet" domestic electrical appliances.

Standard Telephones & Cables, Ltd., Columbia House, Aldwych, London, W.C.2.—Bulletin T.C.601 on traffic control by telephone, with notes on apparatus and hints on maintenance and erection.

Equipment & Engineering Co., Ltd., 2 and 3, Norfolk Street, Strand, London, W.C.2.—A leaflet describing the "Tech-Luchard" portable pressure greasing outfit and metal rectifiers for battery charging.

Z Electric Lamp & Supplies Co., Ltd., 73, Newman Street, London, W.1.—A comprehensive guide to many popular makes of electric fires and other domestic electrical appliances.

The B.E.N. Patents, Ltd., 92, Tottenham Court Road, London, W.1.—An attractive catalogue (No. C.B.12) describing B.E.N. air compressors and paint-spraying equipment.

The English Electric Co., Ltd., Queen's House, Kingsway, London, W.C.2.—Two interesting publications (Nos. M.35 and M.38) giving particulars of oil-immersed switch fuses and the railway electrification between Christchurch and Lyttleton, New Zealand.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1.—A quantity of literature dealing with radio products comprised in the company's 1930 programme, the October issue of "Marconiphone Mail," and a leaflet describing two new outdoor signs.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.4.—Publication No. 6,682 describing a self-acting motor-starter; and No. 6,681 dealing with the company's radio components.

Chesterton, Jones & Co., Ltd., "David" Works, Rushey Lane, Tyseley, Birmingham.—An illustrated folder of "Britalite" industrial lighting reflectors.

The Ever-Ready Company (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.—Two attractive leaflets setting forth the advantages of "Ever-Ready" batteries.

The Wardle Engineering Co., Ltd., Old Trafford, Manchester.—Brochure No. L.555, illustrating the whole range of "Wardelyte" glassware units and "Duro-Ray" shop-window reflectors. Also a folder containing a complete set of current publications.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, London, S.W.1.—A calendar blotter for October.

Walker, Hunter & Co., Ltd., Portdownie Iron Works, Falkirk.—An illustrated folder (E.D. 2,049) giving particulars and prices as well as a colour chart of "Walker" electric fires. Also leaflets E.D. 2,048 and 2,056 describing, respectively, mantel registers with interchangeable coal or "Walker" electric fire, and electric motor-car heaters.

British Insulated Cables, Ltd., Prescot, Lancs.—Leaflet H. 124, on "Helsby" box condensers for power factor correction.

Small Power Dynamo & Motor Co., Ltd., Old Lane, Openshaw, Manchester.—A list (No. 1,030), printed partly in Spanish, compiled especially with a view to the marketing of "Powerlite" lighting and power plant in South America.

The Hamsworthy Engineering Co., Ltd., Poole, Dorset.—An illustrated catalogue (No. 828) giving particulars of the smaller types of petrol-paraffin oil engines.

Taylor, Tunnicliff (Refractories), Ltd., Albion Works, Longton, Staffs.—A card bearing nine short strings of "fish-spine" insulating beads, ranging from 86½ gross to 168 per lb.

Syracuse Washing Machine Corporation, Syracuse, New York.—Folders describing the "Easy" domestic laundry appliances.

The Westminster Tool & Electric Co., Ltd., Westool Works, Putney Bridge Road, London, S.W.15.—An illustrated catalogue of "Westool" electric portable drills and grinders and flexible-shaft tools.

Asea Electric, Ltd., 5, Chancery Lane, London, W.C.2.—Price list A.C.7, covering small single-, two- and three-phase induction motors, together with starting equipment.

The Wholesale Electric Co., Ltd., 37, Vauxhall Bridge Road, London, S.W.1.—Catalogue containing 60 pages of illustrations and matter dealing with cables, switchgear, fittings, glassware, domestic and heating appliances and general accessories.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, London, S.W.1.—October stock list of electric motors, circuit-breakers, &c.

Feed Water Specialists Co., 51, Fenchurch Street, E.C.3.—Technical publication No. 26, dealing with methods of estimating evaporation.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, London, W.C.2.—Pamphlet No. 483, a well-illustrated publication giving prices and particulars of electric fires, water heaters and other domestic appliances; the cover of this catalogue bears a humorous illustration of a coal merchant justly entitled "The Hypocrite." Also pamphlet No. 484, dealing with the new season's fittings and glassware.

A. C. Cossor, Ltd., Cossor Works, Highbury Grove, N.—A useful chart for wireless enthusiasts, showing at a glance every detail required for the identification of British and Continental broadcasting stations. Obtainable by post, price 2d.

Book Notices.

"Mercury Arc Power Rectifiers," by O. K. Marti and H. Winograd. Pp. vii+473; figs. 230. London: McGraw-Hill Publishing Co., Ltd. Price 30s. net.

"Generating Stations," by A. H. Lovell. Pp. xv+359; figs. 171. London: McGraw-Hill Publishing Co., Ltd. Price 30s. net.

"Hire-purchase Accounts and Finance," by C. W. Aston. Pp. viii+222. London: Gee & Co. (Publishers), Ltd. Price 10s. net.

"The Boy Electrician," by A. P. Morgan, new edition revised by J. W. Sims. Pp. 302; figs. 284 and plates. London: George G. Harrap & Co., Ltd. Price 7s. 6d. net.

"Civil Engineering," Vol. 1, No. 1, October, 1930.—Published monthly by the American Society of Civil Engineers. Price 50 cents.

"The Faraday House Journal."—Vol. XIV, No. 1, Michaelmas Term, 1930.

"Science Abstracts" (A & B), Vol. XXXIII, No. 393. London: E. & F. N. Spon, Ltd. Price 3s. 6d. each section.

The Rumanian Brown-Boveri Co.

It is reported from Bucharest that the Brown-Boveri Co., of that city, has increased its share capital from 5 to 20 million lei and is extending its programme. Hitherto the company has represented its Swiss parent company, but it will now also occupy itself with the development of electricity in the directions of production, transmission, distribution and utilisation, and will also undertake the representation of technical concerns, both Rumanian and foreign.

The German Wire Cartel.

The members of the German Federation of Wire Manufacturers (the Drahtverband), have decided to renew the agreement, which was due to expire on September 30th, for a further period of five years. Their combined quota of 900,000 metric tons is to remain unchanged.—*Reuter* (Cologne).

Germany's Electrical Imports and Exports.

According to the official returns just to hand, the imports of electrical machinery and apparatus into Germany during the seven months ended with July last attained a value of £1,211,150 as compared with £1,467,650 in the corresponding period of 1929. On the other hand the exports of these classes from Germany reached a total of £16,199,300, as compared with £15,817,600.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances :—

	CHEMICALS, &c.	Price Oct. 11th	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
c	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... . per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
c	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅞d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£110	£13 dec.
	Grade II ... ... ,, ,,	£81	£9 dec.
	Grade III ... ... ,, ,,	£50	£3 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	7¼d.	¼d. dec.
c	,, Tubes (solid drawn) ... ,,	10d. to 10½d.	¼d. dec.
c	,, Wire, basis ... ... ,,	8¼d.	¼d. dec.
c	Copper Tubes (solid drawn) ... ,,	11½d.	½d. dec.
g	,, Bars (best selected) ... per ton	£75	£2 dec.
g	,, Sheet ... ... ,,	£75	£2 dec.
g	,, Rod ... ... ,,	£75	£2 dec.
d	,, (Electrolytic) Bars ... ,,	£49	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£59	...
d	,, ,, H.C. Wire per lb.	7⅞d.	...
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	1d. dec.
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	5½d.	...
i	Iron, Pig (Cleveland No. 3.) ... per ton.	63/6	...
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£16 15s.	£1 10s. dec.
g	Mercury ... ... per bot.	£22 12s. 6d. to £22 15s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/1d.	...
p	,, ,, rolled strip & sheet ,,	1/2½d.	1½d. inc.
p	,, ,, wire ... ... ,,	1/2¾d.	1¾d. inc.
o	Platinum ... ... per oz.	£7	...
d	Silicium Bronze Wire ... ... per lb.	9⅜d.	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£111 to £112	£14 15s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/1	1d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on October 11th, Messrs. James Forster & Co. stated that a further break in lead values occurred last week, the market declining daily and closing slightly above the lowest price paid. No official support was in evidence, the price being allowed to find its own level. Demand is of a hand-to-mouth nature, while arrivals this month promise to be plentiful, so that no shortage is likely in the near future. However, the price has now reached a level at which some curtailment of supplies may be expected, but this is not likely to be felt for some time. The price may fall lower before any permanent recovery takes place.

The Market for Electrical Supplies in Aleppo.

A confidential report on the market for electrical contractors' supplies in Aleppo has been prepared by the Department of Overseas Trade from information furnished by the Acting British Consul at Aleppo and issued to firms whose names are entered on its special register. United Kingdom firms desirous of receiving a copy of this report should communicate with the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Reference number A.X.10269 should be quoted.

Swiss Electrical Exports.

The exports of electrical machinery, apparatus, and fittings from Switzerland during the six months ended with June last attained a value of £1,757,680, as compared with £1,558,080 in the corresponding half of 1929.

For Sale.

Messrs. Henry Butcher & Co. will offer for sale by auction on Wednesday, November 5th, the leasehold factory at 1-4, Amberley Wharves, Amberley Road, W.9, belonging to the Reliance Rubberware, Ltd., now in liquidation.

Large stocks of electrical and wireless material will be sold by auction on Wednesday, October 22nd, by Mr. George R. Lightfoot, at 13, High Holborn, W.C.

(See our advertisement pages to-day.)

New Australian Company.

The Western New South Wales Electric Power Pty., Ltd., has recently been registered with a capital of £750,000. It has been formed to supply power to the three principal Barrier mines—Broken Hill South, North Broken Hill, and the Zinc Corporation. It is not expected that the plant will be in operation until the end of next year.

Lighting and Power Notes.

Alderley Edge and Wilmslow.—Electrical Development Scheme.—In connection with the relief of unemployment the Electricity Board has decided to carry out a development scheme within the next two years at an estimated cost of £31,000.

Barrow-in-Furness.—Extensions.—The Corporation Electricity Committee recommends that application be made for sanction to a loan of £7,400 for the extension of the electricity supply to Askam and Ireleth, Beckside (Kirkby), Urswick, Greenold, Pennybridge, and Sparkbridge.

Bournemouth.—Proposed Extension of Company's Tenure.—The Town Council, acting in conjunction with the Poole Town Council, has asked the Bournemouth and Poole Electricity Supply Co., Ltd., to state what terms it will be prepared to offer if the Corporations waive their right to purchase the undertaking in 1932 and extend the tenure of the company for another ten years.

Cannock.—Inquiry Demanded.—A proposal was made at a recent meeting of the Urban District Council by Councillor A. Clarke "that the Council direct an inquiry into the administration and financial accounts of the Electricity Department," says the *Birmingham Post*. Councillor Clarke said his remarks had no reference whatever to the present electrical engineer, as the matters to be dealt with occurred before he was appointed. In July last the Council had a shock when the clerk informed it that a certain firm owed the Council Electricity Department something like £900. At a further meeting it was reported that the amount was not £900, but nearer £1,450. He was asking the Council to direct this inquiry to find whether there had been any undue influence used to keep this matter from the Council, and, secondly, whether it would get the whole of this account which was owing to it. All the members were agreeable to an inquiry, and, after a discussion on its form, it was agreed that the matter should be considered at a special meeting of the General Purposes Committee.

Continental.—Portugal.—The Compagnies Réunies Gaz et Electricité de Lisbonne have recently secured a concession to establish a hydro-electric station to utilise the power of the River Zezere.

France.—The Société Hydro-Electrique de l'Ain Inférieure, of Paris, has recently secured a concession for the establishment of a hydro-electric station to utilise certain available water power on the Rivers Ain and Rhone near Chatillon-la-Palud (Department of Ain et Isère). It is estimated that 20,000 kW will be available.

Douglas (Isle of Man).—Loan.—The Town Council has applied for sanction to a loan of £25,606 for additional expenditure on the new generating station at Pulrose and the adaptation of the old station, mains extensions, services, &c.

Eastbourne.—Bulk Supply Terms.—The proposed terms for the bulk supply of electricity from the Central Electricity Board were made known at a recent meeting of the Town Council. As from October 1st, 1930, for a period of twelve months the Board would afford the Corporation a partial bulk supply, the price to be paid being a standing charge of £2 per kW of maximum demand per annum, plus 0.3d. per kWh (subject to coal clause). As from October 1st, 1931, the Board would supply the Corporation, and the Corporation would take the whole of its requirements (including any energy that might still be generated at the Corporation's station at that time) at a standing charge of £3 10s. per annum per kWh of maximum demand, plus 0.295d. per kWh (subject to coal clause). The price would remain in force for a period of seven years as from October 1st, 1931, and thereafter year to year until the Corporation required the Board to substitute for it the Board's tariff for the time being.

Special Order.—Application has been made to the Electricity Commissioners for the Corporation to amend the Eastbourne Electricity (Extension) Draft Special Order so as to include, in addition to the parishes already mentioned in the schedule, the parishes of Eastdean, Folkington, Friston, Jevington, and Wilmington in the Eastbourne rural district.

Edinburgh.—Year's Working.—We have received from Mr. Edwin Seddon, engineer and manager of the city electricity supply undertaking, a copy of his report together with a statement of accounts for the year ended May 15th last. The total revenue amounted to £675,564 and there was a working expenditure of £503,388, leaving a gross profit of £172,176. The figures for the preceding year were: Income, £615,876; working expenses, £452,277; gross profit, £163,599. To the gross profit was added interest on loans (£2,985), and balance from preceding year's account (£51,172), making a total of £226,333 available. From this had to be deducted interest on loans (£54,572), sinking fund contributions (£73,998) and income tax (£6,762), leaving a net surplus of £91,001 (£51,172). During the year £244,415 was spent on capital account, bringing the total now spent on the undertaking to £4,678,076. The sales of electrical energy increased from 112,722,006 to 122,734,993 kWh and the maximum demand from 52,414 to 54,000 kW. It is probable that the Portobello station will be officially taken over by the Central Electricity Board at the beginning of next year, by which time it is expected that the new sea-water culvert will be completed.

Epsom.—Loans.—The Urban District Council Electricity Committee has received sanction to the borrowing of £21,525 for mains extensions, £2,000 for the purchase of apparatus for hire, and £1,000 for wiring installations for hire. The Committee recommends that application be made for sanction to a further loan of £10,000 for mains and services.

Formby.—Termination of Bulk Supply Agreement.—Having failed to secure a further reduction in the price charged for bulk supplies, the U.D.C. has decided to give notice to the railway company supplying its electricity of its intention to terminate the existing agreement on July 14th, 1934. The Council has instructed the clerk and engineer to ascertain whether the railway company is prepared to negotiate for cancelling the existing agreement as soon as the Lancashire Electric Power Co. is in a position to give a supply from the grid. The Council has also decided that failing successful negotiations, a rotary convertor be installed or other means adopted to enable the Council to consume the guaranteed minimum quantity of energy (200,000 kWh per annum) required to be taken from the railway company under the agreement until 1934, and to purchase the balance of its requirements from the Lancashire Electric Power Co.

Free Wiring Scheme.—Sanction has been obtained to a loan of a further £2,000 for carrying out installations under the Council's free wiring scheme.

Hastings.—Extensions.—The Corporation Electricity Committee is to spend £6,555 on mains extensions and the provision of sub-stations to supply the Marina estate, £545 to deal with additional load and to provide a stand-by to the existing transformer installed in the sub-station at the Gypsum Mines, and £500 to provide a sub-station, &c., to augment the supply at the Queen's Hotel.

Hathern.—Inauguration of Supply.—A supply of electricity was switched on at Hathern, Leicestershire, on October 8th, by Mr. S. Hunt, chairman of the Parish Council. The supply is taken from the Loughborough Corporation.

Hull.—Assisted Wiring Scheme.—The Corporation is applying for sanction to the borrowing of a further £25,000 for its assisted wiring scheme.

Electrical Installation at College.—The Corporation Education Committee has obtained sanction to the borrowing of £1,830 for the reconstruction of the electrical installation at the technical college.

Street Lighting.—The Corporation is to convert gas lamps to electricity and light new roads by electricity at a cost of £14,141.

New Pumping Plant.—The Corporation Water Committee is to obtain tenders for oil-engine and electrically-driven pumping machinery for Swanland and Ferriby pumping stations.

Japan.—New Power Station.—Application has been made by the Toshin Denki K.K. for [illegible]rmission to erect a 3,000-kW hydro-electric power station [illegible] the Abukuma River. The Yamaguchi Prefectural Electr[illegible] Bureau, which proposes to erect a 40,000-kW steam pow[illegible]tation, is expected to invite tenders shortly for two 20,000-[illegible]W generators.

Lowestoft.—Change-over Scheme.—The Town Council has decided to proceed with the change-over of the supply in the borough and at Oulton Broad. The public supply to Kessingland has been completed at a cost of £12,000; 56 consumers have been connected, and 35 are waiting to be connected.

Nelson.—Assisted Wiring Scheme.—The Corporation Electricity Committee has given authority for work to be carried out immediately in connection with the wiring of houses on deferred terms.

Northern Ireland.—Electricity Bill.—The autumn session of the Parliament of Northern Ireland began on October 7th. The Electricity Bill is to be read a first time, and then adjourned till the spring; it is intended to carry out a portion of the report of Mr. Kennedy, consulting engineer, London, upon electrical development in Northern Ireland. In his report Mr. Kennedy advocated that the Belfast station should be made the central power station for the greater portion of Counties Down and Armagh, and adjoining districts. In a second report he recommended that the Londonderry station should be utilised as a central power station for the North-West section of Northern Ireland.

It is to be a provisional Bill but sufficiently effective to indicate to all electricity producers the policy of the Government.

Belfast.—The Corporation has decided to make application to the Electricity Commissioners for a Special Order authorising it to supply electricity in various towns and villages in the rural districts of Belfast, Hillsborough, Castlereagh, Newtownards, and Lisburn.

Oldham.—Grid Scheme Preparations.—With reference to the arrangements being made in connection with the grid scheme the Corporation Electricity Committee has agreed to the expenditure of £3,000 on installation of certain plant, and the alteration of the switchgear at the new generating station with the object of providing every possible protection against risk of damage.

Plymouth.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to loans of £5,912 for mains and £1,425 for sub-station equipment.

Scarborough.—Loan.—The Corporation Electricity Committee is to apply for sanction to a loan of £75,000 for the development of the electricity undertaking.

Southport.—Power Station Requirements.—A sub-committee of the Corporation Electricity Committee has been appointed to receive and accept tenders for a storage battery and a motor generator and also for accommodation in connection with the installation of a new switchboard at the Southport generating station.

Stamford.—Electricity Supply at Infirmary.—At a recent meeting of the Managing Committee of the Stamford Infirmary it was decided not to proceed with the installation of a generating plant at the institution. The local electricity supply company had revised [illegible]s quotation, and the Committee, although it considered that it could generate its own electricity at a cheaper rate, did not think it was justified in incurring the expenditure at the present moment.

Stow (Berwickshire).—Inauguration of Supply.—The inauguration of the electricity supply at Stow took place recently, the work having been carried out by the Scottish Southern Electric Supply Co.

Stranraer.—Forthcoming Supply.—At a recent meeting of the Wigtownshire County Council at Stranraer it was reported that the Provisional Order for which the Holderness Trust, Ltd., had applied for supplying the county with electricity had now been passed. The proposal provided for four stations at Stranraer, Wigtown, Newton-Stewart, and Glenluce, from which the surrounding areas would be supplied. The whole sum required had been subscribed and was in the hands of the company. The charge would be about 8d. or 9d. per kWh for lighting and 2d. per kWh for power. A special meeting of the Council will be held to consider the scheme.

Torquay.—Extension Scheme.—At a recent meeting of the Corporation Electricity Committee, the engineer reported that, in connection with the extension schemes, various works costing £21,000 remained to be undertaken. The Committee approved an estimate accordingly.

Loan.—The Electricity Committee is to apply for sanction to a loan of £15,000 for mains and services.

United States.—New Hydro-Electric Station.—The *Financial Times* states that a hydro-electric plant, with a capacity of 200,000 h.p. constructed at Lower Fifteen Mile Falls, on the Connecticut River, by the New England Power Association, a subsidiary of the International Hydro-Electric System, has commenced operations.

Watford.—Electric Heating of Public Baths.—A sub-committee of the Corporation Baths Committee has considered a report of the borough and the electrical engineers and recommends that the heating of the public baths shall be carried out by means of electricity.

Tramway and Railway Notes.

Argentina.—BUENOS AIRES.—The first section of the Lacroze underground railway is to be opened next month. This section will serve the terminus of the Ferrocarril Central de Buenos Aires, and the second section, on which work has commenced, will, like the first, relieve the pressure of urban and suburban traffic on the lines of the railway to its terminus. The suburban traffic on the Central de Buenos Aires is carried in the electric coaches of the Lacroze Tramways Co., which run out over the electrified section of the railway, carrying over 75,000,000 passengers a year. It is estimated that the passenger traffic through the tube will reach 130,000 a day.—*Reuter's Trade Service* (Buenos Aires).

Bradford.—YEAR'S WORKING.—The accounts of the Corporation Tramways Department (general manager: Mr. R. H. Wilkinson) for the year ended March 31st last record a total revenue from the tramways of £540,735, a working expenditure of £455,841, and a gross profit of £84,894. The previous year's figures were: Income, £568,052; working expenses, £458,412; gross profit, £109,640. The railless-car system showed a total revenue of £61,312 (£54,299), working expenses of £56,931 (£51,551), and a gross profit of £4,382 (£2,749). The motor-omnibus system and Parcels Department recorded gross profits of £17,414 and £1,081, respectively, and these, with the gross profits from the tramway and railless cars and revenue from other sources, were carried to the net revenue account, making a total of £108,314 available. Capital and other charges amounted to £138,277 leaving a net deficit of £29,963, as compared with £15,591 in 1928-29. During the year £76,251 was spent on capital account, £32,666 being for railless cars and £29,730 for motor-omnibuses. The total now spent on the undertaking is £1,709,793. The number of passengers carried increased from 116,435,047 (tramways 93,589,130, railless cars 8,532,988) to 118,027,294 (tramways 88,414,713, railless cars 9,323,222) and the car mileage from 10,376,868 (tramways 7,313,725, railless cars 1,081,848) to 11,276,200 (tramways 7,113,736, railless cars 1,174,387). The total revenue per car mile fell from 17.138d. to 16.631d.

Continental.—SWITZERLAND.—A concession is expected to be granted shortly to the commune of Davos for the construction of a new electric railway from Davos Village up to the Wasserscheide. The new railway will have a difference of level of 1,114 m. between Davos Village and the Wasserscheide, and will be 3,975 m. long. The cost of construction is estimated at 1,820,000 francs.

Irish Free State.—CORK.—It is stated by *Modern Transport* that the directors of the Cork City Tramways Company are considering the substitution of omnibuses for the tramways, and also a scheme for an "all-in passenger service" to be submitted to the Cork Corporation for approval.

Japan.—A SUSPENDED ELECTRIC RAILWAY.—The Nippon Kuchu Denki Totsudo K.K. contemplates the construction of a suspended electric railway costing 500,000 yen between Katase and Yenoshima.

Manchester.—RAILWAY ELECTRIFICATION.—According to the *Daily Dispatch*, the electrification of the joint L.M.S. and L.N.E.R. line between Manchester and Altrincham, work on which has been going on for over twelve months, is not likely to be completed until next summer. It was anticipated that experimental trips with trial electric trains would be made over the new route this month, but these have been delayed for various reasons. It is possible that a trial over one section between Stretford and Sale will be made before the end of this year. At the moment, however, only one short stretch of line is nearing completion and there is no possibility of any public electrified service being put into operation until the conversion of the whole of the route has been completed.

United States.—RAILWAY ELECTRIFICATION.—Progress of railroad electrification in the United States and in foreign countries during the past year indicates a very lively interest in this subject, according to a report issued recently by the Electrification of Steam Railroads Committee of the National Electric Light Association. The Baltimore and Ohio Railroad has announced its intention of electrifying the main line of the Central Railroad of New Jersey and the Reading, contingent upon the expected consolidation of these railroads into its system. The length of this line is 224 miles, all of which has two or more tracks. Last year the Reading announced that it would electrify its suburban lines in the vicinity of Philadelphia, intimating probable extensions to New York, Bethlehem and Reading. The programme at that time covered 50 miles of route and 110 miles of track. It has now been decided to electrify also the Dolyestown branch, extending ten miles from Lansdale. The Pennsylvania has greatly expanded its programme which, as announced last year, included the electrification of all services between New York City and Wilmington, Delaware. Following the conclusion of plans for new and larger tunnels at Baltimore, the Southern terminus of electrification was moved from Wilmington to Washington, D.C. Completion of this project on the larger scale will give the Pennsylvania railroad system 799 miles of line and 2,759 miles of track electrically operated. The electrification of the Montclair branch of the Delaware, Lackawanna and Western is rapidly approaching completion. The Illinois Central has completed and placed in operation the electrification of its freight services north of Thirty-ninth Street, Chicago, with more than 21 miles of track wired for this service. The New York Central is engaged in electrifying its West Side freight line, which extends nearly the whole length of Manhattan Island.

Telegraph and Telephone Notes.

International Radio-telephony.—PROPOSED SERVICE WITH JAPAN.—According to the *Wireless World*, new directional equipment is being erected at the G.P.O. wireless station at Rugby in preparation for radio-telephony tests between this country and Japan. Arrangements for the tests were fully discussed with Dr. Inada, Japanese Minister of Posts and Telephones, on his recent visit to England, and preliminary experiments may start in a few weeks' time. Should the tests prove successful, a public service will be opened with Japan similar to the existing transatlantic service.

Italy.—COMPULSORY WIRELESS RECEPTION ON SHIPS.—The *Wireless World* states that from December 31st next a Royal Decree, postponed to permit the manufacture of sufficient apparatus, will require all Italian non-passenger ships of less than 1,600 tons gross to carry a wireless set capable of receiving the Rome weather forecasts within a radius of 625 miles.

Manchuria.—LONG-DISTANCE TELEPHONE SERVICE.—According to the *Chinese Economic Bulletin*, plans for the provision of long-distance telephone service connecting the various important cities and districts in the north-eastern provinces have been approved by the North-eastern Political Affairs Committee. It is stated that the proposed long-distance system will cover a total distance of about 667 miles, the cost of construction being estimated at $4,000,000. German and American manufacturers are tendering for the contract.

New Zealand.—RADIO-TELEPHONY SERVICE WITH LONDON.—Short-wave telephone communication between Wellington, Sydney, and London, will come into operation in about a week's time. Preliminary tests are stated to have proved highly satisfactory. The first conversation will be held between Mr. Forbes, Premier of New Zealand, now in London for the Imperial Conference, and Mr. Ransom, the Acting Prime Minister.—*Reuter* (Wellington).

Radio Notes.

China.—NEW STATION.—The *Chinese Economic Bulletin* states that preparations are well advanced for the construction of a large radio station for the broadcasting of news, speeches and music. The Radio Administration of the Ministry of Communications has prepared a set of regulations and all private owners of radio receivers will have to be registered.

Continental.—NEW STATIONS.—Orders have been received by Marconi's Wireless Telegraph Co., Ltd., for the installation of high-power broadcasting stations in Italy and Finland. The former will be erected at Trieste, in accordance with the Italian Broadcasting Company's plan for the development of its system, and the new Finnish station will be erected at Viipuri. The aerial energy of the Trieste transmitter will be of 15 kW, C.C.I.R. rating, with a maximum modulation of 100 per cent. It will be designed to cover wave bands between 200 and 545 metres, but the normal working wave of the station will be 247.7 metres. The Finnish station will have an aerial energy of 13.2 kW, C.C.I.R. rating, at 80 per cent. modulation. It will incorporate an oscillating crystal instead of the valve-drive frequency control which will be used in the Italian transmitter. In addition to the transmitter for Viipuri, the Marconi Company has received an order for the supply of land-line and speech-control equipment for simultaneous broadcasting from Viipuri and the existing Finnish station at Helsingfors. These two orders for transmitters bring the number of Marconi broadcasting installations supplied and installed, or ordered, this year up to 14, spread over nine countries in Europe, apart from those for other parts of the world.

Empire Transmitter.—PROJECT CONSIDERED.—The Communications Committee of the Imperial Conference now taking place in London discussed on October 9th the advisability of establishing a radio-telephone transmitter in England to broadcast a daily general and news programme to the whole of the British Empire. It concluded unanimously that, if well administered, such a project would powerfully influence Imperial unity.

Germany.—BROADCASTING COMPANY'S SALARY REDUCTIONS.—With a view, it is said, to effecting an all-round reduction in salaries and wages, the whole of the personnel employed by the West German Broadcasting Company (Westdeutschen

Rundfunk) has been given notice of discharge. Next to the State Broadcasting Company, which holds the majority of its shares, the West German Broadcasting Company is the largest broadcasting concern in Germany. It earns considerable profits, for which reason the measure of economy proposed has caused surprise, both among the staff and the listening public generally.—*Reuter* (Cologne).

Loud-speakers. — By-laws. — The Essex County Council recently passed a by-law prohibiting the use of radio loud-speakers in country districts in such a manner as to cause annoyance.

On October 8th the Holborn (London) Municipal Council was recommended by one of its committees to pass a by-law which is so framed as to prohibit the use of loud-speakers in shops and on other premises when such use causes public annoyance.

New Zealand.—The Future of Broadcasting.—Following his announcement in the House of Representatives recently that in 1932 the Government would assume control of broadcasting in New Zealand, the Postmaster-General has stated that the Government does not intend to create a state monopoly of broadcasting. It will assume control of the technical side but does not intend to control the programmes.—*Reuter's Trade Service* (Wellington).

Regional Broadcasting.—Programme Re-arrangement.—Owing to the shortness of the London "National" wavelength (261.3 metres) and the consequent rapid falling off of the strength of transmission as the distance from the transmitter increases, the B.B.C. has altered slightly the arrangement of the programmes, particularly during mornings and afternoons, so as to use to the fullest extent the greater strength of the London "Regional" transmitter on the 356.3-m. wavelength. In general, when there is only one programme, the "Regional" transmitter will be used, the same programme being sent out from the long-wave (5XX, 1,554.4-m.) Daventry station.

Relay Exchanges.—Watford.—At a recent meeting of the Corporation Highways Committee, the town clerk submitted a letter from Broadcast Relay Services, Ltd., for permission to establish a broadcast relay exchange at Watford. The company would be prepared to pay the Corporation £250 per thousand subscribers and a minimum fee of £500 for the few road crossings it might make. The town clerk also submitted a letter from Mr. R. R. Goding stating that he wished to make an application to the Council for permission to form a company in Watford which would be able to offer all householders continuous wireless programmes at a rent of 1s. 6d. per week. A sub-committee was appointed to inspect the services in operation at Clacton-on-Sea, where a similar service has been in operation for a much longer period.

Bradford.—The Corporation has granted the application of the Selective Radio Relay Company to extend its wireless distribution service to the Undercliffe, Eccleshill, Idle, Thackley, and Bowling districts.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement s given in parentheses below.

Contracts Open.

Australia.—Melbourne.—Posts and Telegraphs Department. November 18th. Telephone receivers, ebonite earpieces, &c. (A.X. 10183.)*
October 28th. Radio terminal telephone equipment. (A.X. 10288.)*
November 25th. Motor-generator sets. (A.X. 10184.)*
January 6th, 1931. Submarine cable. (A.X. 10309.)*
December 2nd. Cord tags. (A.X. 10332.)*

Bradford.—November 8th. Tramways Committee. Twelve months' supply of stores, including electrical fittings for tramcars (Sch. No. 3), insulating material and delivery hose (No. 4), insulated bolts, strains and copper controller contacts (No. 7). Schedules numbered as above from tramway general manager, 11, Forster Square.

India.—New Delhi.—October 27th. India Store Department. Electricity meters. (A.X. 10287.)*
October 27th. Transformers and switchgear for the Lloyd Barrage, Sukkur. (A.X. 10333.)*

Irish Free State.—Dublin.—October 23rd. Irish Press, Ltd. Supply and installation of electrical equipment at company's offices at 12-13, Burgh Quay. (October 10th.)

Leyton.—October 31st. Town Council. Fifty tramcar bodies and trucks, with electrical equipment and magnetic track and wheel brake equipments, &c.; also one electrically-operated car traverser. (October 3rd.)

Liverpool.—October 21st. Electricity Supply Department. Motor-generator sets. (October 3rd.)

London. — Central Electricity Board. — October 20th. Metering equipment for certain stations in connection with the Mid-East England Electricity Scheme. (September 5th.)
November 3rd. 132,000-V overhead transmission lines for the South-West England and South Wales Electricity Scheme. (September 26th.)
November 3rd. 132,000-V overhead transmission lines for the North-East England Electricity Scheme. (September 26th.)
November 3rd. Construction of site works, foundation works and buildings in the area of the Central England Electricity Scheme. (September 26th.)
November 10th. 66,000-V transformers. (October 10th.)
November 24th. 66-kV and lower voltage transformers. (See this issue.)
County of London Electric Supply Co., Ltd.—October 24th. Two 75,000-kW c.m.r. turbo-alternators, circulating water screening plant, condensing plant and auxiliary apparatus, and overhead electric travelling cranes, in connection with Barking power station extensions (September 19th.)
November 11th. Circulating water pumps and pump house equipment, in connection with the extensions. (October 10th.)
London County Council.—November 3rd. Two 20,000-kW turbo-alternators, condensing plant, &c. (September 26th.)
H.M. Office of Works.—October 20th. Electric wire and cable. (October 10th.)
October 31st. Rewiring, for electric lighting and power, at Queen Anne's Chambers, Broadway, Westminster, S.W. (See this issue.)
Southwark.—November 7th. Borough Council. Twelve months' supply of electric cables. (See this issue.)

Newport.—Corporation Electricity Department. A 50/75- or 100-kVA motor generator. (See this issue.)

New Zealand.—Wellington.—Post and Telegraph Department. November 4th. Telephone cable. (A.X. 10242.)*
November 20th. Telephone cordage. (A.X. 10243.)*
November 25th. Rubber insulator rings. (A.X. 10293.)*
Automatic table telephones. (A.X. 10295.)*
December 2nd. Automatic dials. (A.X. 10294.)*
December 15th. Transmitters. (A.X. 10362.)*

Omagh, Co. Tyrone.—October 21st. Urban District Council. A.c. house service type meters. (October 10th.)

Saltcoats (Ayrshire).—October 23rd. Town Council. Electrical work at 72 houses. Specifications from H. Thomson and Sons, architects and surveyors, 60, Hamilton Street. Offers to Town Clerk.

Smethwick.—October 31st. Education Committee. Electric lighting of the Uplands School. (September 26th.)

South Africa.—Pretoria.—November 21st. Department of Posts and Telegraphs. Dry cells and battery material. (A.X. 10244.)*
November 7th. Town Council. Induction voltage regulators. (A.X. 10360.)* Split conductor cable. (A.X. 10361.)*
Durban.—October 24th. Corporation Electricity Department. Ten single-phase transformers. (A.X. 10277.)*
Cape Town.—November 27th. City Electricity Department. Thirteen 3-phase transformers. (A.X. 10322.)*
Kingwilliamstown.—December 2nd. Municipal Council. Turbo-alternators, centrifugal pumps and switchgear. (A.X. 10353.)*

Uruguay.—Montevideo.—October 31st. Public Cleansing Department. 1,000-kW turbo-generator, switchgear, transformers and waste fuel boilers. (A.X. 10180.)*
October 31st. State Electricity Supply Works. Electricity meters and spares. (A.X. 10254.)*

Wakefield.—October 27th. Installation of electric lighting and bells at Maltby Secondary School. Education Officer, County Hall.
November 3rd. Installation of electric lighting at Adwick-le-Street, Woodlands Senior School. Education Officer, County Hall.

Warmley.—November 8th. Rural District Council. H.p. and l.p. cables with poles, switchgear and transformers. (October 10th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Bradford.—Watch Committee. Recommended :—
Four sets of traffic signals (£600).—Revo Electric Co., Ltd.

Bristol.—Bristol Tramways and Carriage Co. Accepted :—
Phono-electric trolley wire.—Equipment & Engineering Co., Ltd.
Health Committee. Recommended :—
Telephone installation Novers Hill Hospital (£113).—Siemens Bros. & Co., Ltd.

Chesterfield.—Corporation. Accepted :—
E.h.p. cables (£975).—Derby Cables, Ltd.
Two draw-out truck type cubicles (£256).—British Thomson-Houston Co., Ltd.

Carlisle.—Electricity Committee. Accepted :—
Erection of overhead transmission line between Cocklakes and Brampton.—Johnson & Phillips, Ltd.

Dunfermline.—Town Council. Accepted :—
Installation of electric light at eight blocks of houses.—J. R. Beveridge.

Glasgow.—Corporation Lighting Committee.—We regret that by an error we reported that it was recommended that orders for 500 large and 500 small lanterns should be placed with the Wardle Engineering Co., Ltd. Actually the offer of the General Electric Co., Ltd., for the large lanterns was recommended, the Wardle Company's tender being for the small ones.

Hull.—Public Assistance Committee. Accepted :—
Electrical supplies for three months.—Clark & Graham.
Health Committee. Accepted :—
Electric cooking appliances (£385).—General Electric Co., Ltd.
Water Committee. Accepted :—
Electric lighting installation at Dunswell pumping station (£138).—C. J. W. Monson.
Telephones Committee. Provision of automatic switchboard at Guildhall :—

	£
Shipton & Co., Ltd. (Recommended)	1,643
Automatic Telephone Manufacturing Co., Ltd.	1,974
Reliance Telephone Co., Ltd.	1,983
Ericsson Telephones, Ltd.	1,995
Standard Telephones & Cables, Ltd.	2,111

Education Committee. Accepted :—
Electric lighting at Flinton Grove school (£1,074).—Napier and Wheeldon.

London.—Metropolitan Water Board. Accepted :—
Electrical requirements at Deptford works (£137).—Siemens Electric Lamps & Supplies, Ltd.
12-h.p. motor for coal transporter at Walton station (£101).—Crompton Parkinson, Ltd.
St. Marylebone.—Electric Supply Committee. Recommended :—
Transformers.—Metropolitan-Vickers Electrical Co., Ltd.; British Electric Transformer Co., Ltd.
Switchgear.—Ferguson-Pailin, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.

Lurgan (Co. Armagh).—Urban District Council. Accepted :—
Transformers, erecting overhead lines and laying underground cables (£6,914).—W. T. Henley's Telegraph Works Co., Ltd.

Manchester.—Paving Committee. Accepted :—
Electric wiring in connection with penstock chambers at Marple Street, Hulme.—F. Bowen.
Education Committee. Accepted :—
Electrical installation at the Barlow Hall Municipal School.—R. Seddon & Sons.

Plymouth.—Health Committee. Accepted :—
Automatic telephone equipment at city hospital (£298).—Standard Telephones & Cables, Ltd.
Mental Hospital Committee. Accepted :—
Renewing batteries at mental hospital (£600).—Tudor Accumulator Co., Ltd.

Portsmouth.—Electricity Committee. Recommended :—
Cables.—Johnson & Phillips, Ltd. (£2,557); District Transmission Lines, Ltd. (£81).

Uttoxeter.—Urban District Council. Accepted :—
Extending e.h.p. transmission line from Seven Acres Lane to Park Avenue housing estate (£1,099).—Power Lines Construction Co., Ltd.

Wakefield.—Housing Committee. Accepted :—
Electric lighting and heating at 50 houses on Lupset estate (£397).—H. Smith.

York.—Sewage Committee. Accepted :—
Two electric pumps, &c., at Fulford pumping station (£1,577).—Rees Roturbo Manufacturing Co., Ltd.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices :—

P. & H. warm air convectors.
Yale Bond electric torches.
Bridges patent locking tile covers.
Brum electric irons.

We also have an enquiry for the London agents of Messrs. Jydsk Electro (Danish).

Notes.

Electricity in Medical Practice.

The opening meeting for the 1930-31 session of the Edinburgh Electrical Society was held at Edinburgh on October 1st. Mr. James Walker presided, and the meeting was fairly well attended. A lecture on "Electricity: the Handmaiden of Modern Medicine," was delivered by Dr. Elizabeth C. Mudie, Glasgow, who stated that the greatest factor in the advance of medicine during the past century was perhaps the progress of electricity. She sketched early developments and showed how electricity in its various forms now pervaded both the curative and diagnostic fields in up-to-date medical practice. In surgery thermo-cautery and diathermy made possible operations which could never otherwise have been attempted. The lecturer treated also of the development and application of artificial sunlight, which prevented disease as well as cured it; real direct sunlight was absent in this country for two-thirds of the year. Dr. Mudie expressed the opinion that it might be well to make illegal the consumption of raw coal in an open grate, and thus hasten the day when electric heating would become universal. The lecturer concluded with a reference to the work of Madame Curie and the importance of radium emanations in medicine. The lecture was illustrated with lantern slides and practical demonstrations of electro-medical appliances.

Ships' Radio Equipment.

The wireless installation of the *Winchester Castle* has been supplied by the Radio Communication Company, Ltd., and comprises valve transmitters and receivers for long and short wavelengths, two lifeboat sets, and a radio direction finder. The interrupted-continuous-wave method of communication will be used by the two transmitters, which will operate from a common source of high-voltage power supply. One transmitter will cover the short wavelength between 16 and 40 metres and the other will operate over the wavebands between 600 and 800 metres and 1,800 to 2,800 metres, so that long-distance communication will be easily effected throughout the voyage, even to the extent of keeping in direct touch with Great Britain from the southern latitudes. Valve receivers of recent design, selective for long-distance reception, will cover the wavelengths used by the ship's transmitters and also all other wavelengths on which is transmitted information of service and interest to the navigators, passengers, and crew.

The radio direction finder consists of a single frame, or loop, aerial rotated by a hand-wheel, and the direction of the bearing relative to the ship's head is indicated by a pointer on an engraved scale mounted above this wheel. A five-valve super-heterodyne receiver is used with the direction finder and a very high degree of sensitivity is obtained.

The lifeboat radio equipment has been specially designed to comply with all regulations and has been tested and officially approved by the Board of Trade and General Post Office. It is fully protected against bad weather and sea water, and also meets conditions of tropical service.

The Canadian Pacific liner *Empress of Britain*, which was launched in June, will carry a Marconi short-wave wireless telephone installation when she enters the Atlantic service next year. The equipment will allow passengers to communicate with telephone subscribers in Europe, Canada, and the United States through appropriate land stations. The input power will be 20 kilowatts, and the installation will be similar to that used recently by the Marchese Marconi on his yacht *Elettra* when he spoke from the Mediterranean to London, Buenos Aires, Rio de Janeiro, New York, Montreal, Bombay, Cape Town, and Sydney.

Fatality.

An inquest was held at Pendleton on October 8th on Arthur Clarence Illingworth (47), who was fatally injured whilst employed by the Lancashire Electric Power Co. According to the *Manchester Evening Chronicle*, evidence was given that deceased slipped from a transformer and came into contact with a "live" wire. A verdict of "Accidental death" was returned.

Appointments Vacant.

Meter records clerk for the Gellygaer Electricity Department.

An unestablished engineering assistant for the Electricity Commissioners.

(See our advertisement pages to-day.)

The Electrical Association for Women.

Under the auspices of the Glasgow branch of the Association a lecture was given at a luncheon in the Ca'dora Restaurant on October 13th by Mr. G. S. Francis, Electrical Development Association, on the social consequences of electrical development.

A luncheon, presided over by Viscountess Elibank, president of the Edinburgh branch, was held in Edinburgh on October 11th. Viscountess Elibank said that electricity could banish drudgery and do away with monotonous toil in the home. Mr. William Adamson, Secretary of State for Scotland, said the chief object of the Association was to teach women what electrical power could do for them, and thereby lead them to fuller and happier lives. That the use of electricity in Edinburgh was making rapid strides was shown by the fact that the electricity supply business in the city had increased by 100 per cent. in the last five years. The total capital invested in the undertaking amounted to £4,700,000, and the cost of the super-station at Portobello was £2,100,000.

Lady Belhaven and Stenton said the branch in Glasgow, which was formed six years ago, now had a membership of over 300.

Through the kindness of Mr. F. H. Corson, city electrical engineer, Gloucester, a party of members of the Mid-Gloucestershire branch was privileged to visit a few representative sub-stations outside the city, and also the main power station at Commercial Road, on October 9th. After the visits, Mr. Corson kindly entertained the party to tea in his office.

Steam-turbine Reliability.

The National Electric Light Association (U.S.A.) has investigated the performance of 207 steam turbines with regard to availability for carrying load. The anaylsis in the following table shows that the number of hours (including annual overhaul) during which the sets were out of commission was 5.44 per cent. of the total. Apart from overhaul, it will be seen that the percentage was only about 2.89 per cent. Blading and nozzles provided by far the largest proportion of failures, accounting for about 35 per cent. of the total hours, excluding periods of overhaul.

	Outage Hours.	Per cent.	No. of Units affected.
Steam casing	1,614	1.68	41
Governors	1,025	1.06	69
Control gear	2,947	3.06	74
Shaft packing	5,358	5.57	54
Nozzles and diaphragms...	3,340	3.47	19
Shaft	778	.81	11
Wheels	5,322	5.53	31
Buckets or blades	18,010	18.71	41
Vibration	3,011	3.13	25
Bearings	2,543	2.64	55
Lubrication	1,168	1.21	79
Cleaning oil system ...	2,315	2.40	86
Annual overhaul	45,164	46,93	113
Misc. and unclassified ...	3,667	3.80	61
Total	96,262		
Per cent. outage	5.44		

Association of Supervising Electrical Engineers.

The opening meeting of the A.S.E.E. will be held on Tuesday, October 21st, when Mr. S. B. Donkin will deliver his presidential address. The meetings will be held in the lecture room at the Junior Institution of Engineers, 39, Victoria Street, London, S.W.1, commencing at 7.15 p.m. The following list shows a programme of subjects and lecturers of outstanding importance: Nov. 18th, "Characteristics of Electric Lamps as modified by Modern Methods of Manufacture," by Mr. L. E. Buckell; Dec. 16th, "Electric Panel Warming of Buildings," by Mr. R. Grierson; Jan. 20th, "Progress in Power Cable Technique," by Mr. P. Dunsheath, O.B.E.; Feb. 17th, "Modern Power Station Turbo-Alternators," by Mr. L. H. L. Badham and Mr. L. J. Cheshire, M.Sc.; March 17th, "Modern Electric Traction," by Mr. R. Brooks, B.Sc.; April 21st, "Electric Welding," by Mr. W. E. Quine and Mr. E. F. Newell.

The Board of Control announces the eighth annual competition for the "W. E. Highfield" shield, which was presented for competition by Mr. W. E. Highfield, M.I.E.E., when he was president of the Association. In addition, five valuable prizes will be offered, three to members and two to Associates, as follows:—*Members*: First prize, value five guineas, by The Metropolitan-Vickers Electrical Co., Ltd.; second prize, value four guineas, by Siemens Bros. & Co., Ltd.; third prize, value three guineas, by The Sun Electrical Co., Ltd. *Associates*: First prize, value five guineas, by W. T. Henley's Telegraph Works Co., Ltd.; second prize, value three guineas, by The Revo Electric Co., Ltd.

The winner of the first prize will be the holder of the shield for one year, his name being suitably inscribed thereon, and winners of prizes will also receive certificates. The rules of the competition are as follows: papers not to exceed 2,000 words; subjects of papers must refer to the electrical industry and/or the Association; all papers, addressed to the general secretary, must reach head office not later than 12 o'clock noon on Tuesday, November 25th, 1930; all papers will be typed out by head office and each paper given a number—the typed copies will be judged by a special examining board, which will select the winning papers. The names of the writers of the papers will be known only to the general secretary, who will not disclose the names until after the decision of the examiners has been received; a signed declaration, that the paper is the unaided work of the competitor, must accompany each paper.

The Treatment of Flue Gases.

Under the above heading in the Electrical Review of October 10th reference was made to the patent specification in the joint names of the London Power Company and Dr. S. L. Pearce, for the treatment of flue gases. The date on which the patent specification (No. 334,660) was complete accepted was September 11th, 1930.

A Small Country Town Supply.

The Bungay Electricity Co., which has recently taken a bulk supply of electricity from the Great Yarmouth electricity undertaking, has been able to reduce its tariffs considerably, and on October 8th a meeting of the townspeople was addressed by Miss C. Haslett, a director of the company. As a result of the bulk supply, the company has been able to reduce the tariffs from 10d. and 4d. per kWh, respectively, to a 2-part tariff with a small standing charge plus 1½d. per kWh. An exhibition of electrical appliances arranged by the engineer and manager, Mr. E. E. Messenger, in conjunction with the Hotpoint Electrical Co., Ltd., was recently held, and Miss Dorothy Vaughan lectured to the townspeople each afternoon; during the mornings groups of children were brought from the local schools.

The E.P.E.A. and the Glasgow Change-over.

The Glasgow Corporation Electricity Committee recently considered the representations made by the Electrical Power Engineers' Association in support of a claim on behalf of a large portion of the technical staff of the Electricity Department for recognition of their services and responsibility in connection with the change of frequency work. Having heard the district engineer of the Central Electricity Board, who reported the view of the Board, which is financially responsible for carrying out the work, that it was averse from the granting of any bonuses for extra duties, the committee recommended that the claim be refused, and that the applicants be informed that as they are staff employés, the manager is entitled, having regard to the nature of their engagements, to call on them to execute work as and when required without additional remuneration.

Cable for Electric Totalisator.

The electric totalisators now installed on many racecourses have created a demand for a special type of cable for connecting the apparatus in the ticket-issuing booths to the main equipment. The cable is somewhat similar in general appearance to a telephone or telegraph cable, but the conductors are tightly wrapped with two layers of paper, as compared with the single layer in an air-space telephone cable. British Insulated Cables, Ltd., have supplied considerable quantities of these cables, a recent example being composed of 300 conductors, 10-lb. per mile, lead-covered and single-wire armoured, with specially heavy impregnated hessian tapes under and over the armour. The power cables supplied for use with the same apparatus are of considerable size, a recent example being composed of seven 0.12 sq. in. cores, lead covered and armoured.

Educational.

Northampton Polytechnical Institute, St. John Street, E.C.1.—A course of five lectures on "Modern Acoustics" is to be given by Mr. A. H. Davis, D.Sc., on Wednesday evenings commencing on October 29th.

(See our advertisement pages to-day.)

The Physical Society's Exhibition.

The twenty-first annual exhibition of electrical, optical, and other physical apparatus is to be held by the Physical Society and the Optical Society on January 6th, 7th, and 8th, 1931, at the Imperial College of Science and Technology, South Kensington. As on the previous occasion (which was described in the Electrical Review of January 17th, 24th, and 31st, 1930) there will be a trade section and a research and experimental section. The section for the work of apprentices and learners, introduced at the last exhibition, is to be continued.

The trade section will comprise the exhibits of manufacturing firms, and preliminary invitations to these exhibitors are being issued, entries being asked for by October 24th.

The research and experimental section will be arranged in three groups: (*a*) exhibits illustrating the results of recent physical research; (*b*) lecture experiments in physics; (*c*) historical exhibits in physics.

O.L.A. Supper-dance.

Intending participants in the conversazione and supper-dance to be held by the Overhead Lines Association on Friday, October 31st, are reminded that applications for tickets (12s. 6d. each, including supper) should be made at once to Mr. G. Molle, 146, Bishopsgate, London, E.C.2, who is also in charge of the exhibits of overhead-line materials and accessories.

The exhibition committee invites offers from research laboratories and institutions and from individual research workers, of exhibits suitable for inclusion in any of the above three groups. Accommodation for these exhibits will be provided in rooms separate from those devoted to the trade exhibits, and a part of the catalogue will be devoted to their description. No charge will be made for space or catalogue entries in the research and experimental section. Offers of exhibits, with particulars of space and other facilities required, should be communicated immediately, and in any case not later than October 30th, to the Secretary, Exhibition Committee, 1, Lowther Gardens, Exhibition Road, London, S.W.7.

The section for apprentices and learners has for its object the encouragement of craftsmanship and draughtsmanship in the scientific instrument trade. Apprentices and learners may exhibit, in competition, specimens of their work, providing they are in the regular employ of a firm which is exhibiting at the next annual exhibition, or has exhibited once during the past three years. Printed particulars of this section will be sent on application to the secretary.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. J. F. Wallace, the author of the article on "Tales Engineers Tell" published elsewhere in this issue, is an assistant secretary of the Electrical Power Engineers' Association. Soon after an apprenticeship completed at the Vulcan Foundry Locomotive Works, Lancashire, Mr. Wallace ventured into commercial life *via* the sales office of a well-known Liverpool business house. Returning to his earlier vocation he was with the Admiralty for seven years in the Electrical Departments, first at Chatham and then at Rosyth Naval Dockyards. During the war and post-war years Mr. Wallace acted on a Government Committee set up to advise the Minister of Labour on the resettlement of ex-service apprentices, and followed this by acting on the Scottish Board for the Engineering Trades created to adjudicate on claims arising for compensation when indentures had been broken. He also sat on the Advisory Committee for the East of Scotland when the Labour Exchanges were called on to deal with the closing down of munition factories, and later on the Employment Committee and the many resettlement committees arising therefrom. Besides this he was a member of the Central Profiteering Committee for Scotland and other bodies of a like nature. In 1920, the Government, alarmed at the growing prices of house-building, set up a committee of inquiry into the costs of house-building in Scotland, and Mr. Wallace was given a seat on this committee which was remarkable in that the Government adopted most of its recommendations. He was appointed

Mr. J. F. Wallace.
Assistant Secretary of the E.P.E.A.

Scottish secretary to the E.P.E.A. some nine years ago and has progressively advanced to his present position as assistant secretary.

Mr. B. H. Leeson, who is this session's chairman of the North-Eastern Centre of the Institution of Electrical Engineers, was born at Sutton, Surrey, in 1890, and received his training in electrical and mechanical engineering at Battersea Polytechnic Institute. He was apprenticed to Messrs. Prestwich and Burt, electrical and mechanical engineers, afterwards becoming assistant works manager to Messrs. William White and Co., London. He then held an appointment as a switchgear engineer with Siemens Bros.' Dynamo Works, Ltd., until the outbreak of war, when he joined the Royal Naval Divisional Engineers and served in Gallipoli, Egypt, and France, being mentioned in dispatches. From 1908 to 1914 he served in the London Electrical Engineers, and he has held a commission in the Tyne Electrical Engineers (T.A.) since 1917. Mr. Leeson joined Messrs. A. Reyrolle & Co., Ltd., in 1919, and for ten years has been chief of their technical and research department. In recent years he has been associated in the devising of feeder protective systems and the "centrovisory" system of power station control as used in connection with the "grid." He is the author of "Protective Systems for a.c.

Elliott & Fry [*London.*

Mr. B. H. Leeson.
Chairman of the North-Eastern Centre of the I.E.E.

Mains" (Pitman), and has been responsible for the design and organisation of Messrs. Reyrolle's short-circuit test plant (described in the ELECTRICAL REVIEW, May 30th, page 996) which is the only one of its kind in Britain, and probably one of the best equipped in the world for carrying out research on the performance of switchgear. He has been associated intimately with the preparation of British Standard Specification No. 116 for "Oil-Immersed Switches and Circuit Breakers," and at the I.E.C. Plenary Meeting held at Stockholm in June he represented British manufacturers on Committee No. 17 for "Oil-Immersed Switches and Circuit-breakers." Mr. Leeson joined the I.E.E. as a student over 20 years ago; he is to deliver his inaugural address on October 27th.

Major R. W. Clarke has retired from the post of Trade Commissioner at Bombay and **Mr. W. D. Montgomery Clarke,** Trade Commissioner at Calcutta, has been appointed in his place. Mr. Montgomery Clarke will be succeeded by **Mr. R. B. Willmot,** assistant to the Senior Trade Commissioner at Calcutta.

The Lord President of the Council has appointed **Mr. E. J. Butler,** C.I.E., F.R.S., **Mr. Kenneth Lee,** LL.D., and **Mr. N. V. Sidgwick,** O.B.E., F.R.S., to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research. The following members of the Advisory Council have retired on completion of their terms of office: **Professor V. H. Blackman,** F.R.S. (chairman since April, 1930), **Professor F. G. Donnan,** C.B.E., F.R.S., and **Professor F. A. Lindemann,** F.R.S. **Sir Ernest Rutherford,** O.M., Pres. R.S., is now chairman of the Council.

The Hull Corporation Telephone Committee has considered the request of a firm of consulting engineers in London for permission to include the name of the telephone manager **(Mr. T. Holme)** in a list of engineers to be submitted to the Corporation of Durban, which is seeking advice in connection with telephone matters, and has decided that in the event of Mr. Holme being selected he shall be granted leave of absence without salary for a period not exceeding four months to enable him to go to Durban.

Dr. F. E. Smith, secretary of the Royal Society, was granted the honorary degree of LL.D. of the University of Birmingham on October 13th upon the occasion of the celebration of the jubilee of Mason Science College.

Sir James Lithgow, Bt., who was one of the original members of the Central Electricity Board appointed in 1927, has resigned from the Board in view of the pressure of his other duties, and the Minister of Transport has appointed in his place **Sir Ralph L. Wedgwood, C.B., C.M.G.**, chief general manager of the London and North-Eastern Railway Company.

Mr. O. G. Cook, formerly of Leicester, has been appointed first electrical engineer of Barnoldswick. For 18 months he has been clerk of works under Mr. R. Blackmore, on the Barnoldswick scheme. Mr. Cook was articled to the electrical engineer of Morecambe, and later served with Lancaster Corporation.

Mr. S. H. Joynes, for many years with the Metropolitan-Vickers Electrical Co., Ltd., has been appointed in charge of the London sales for Messrs. George H. Scholes & Co., Ltd.

Mr. H. A. Blackburn, who has been appointed tramway manager to Great Yarmouth Corporation, was last week presented with a canteen of cutlery by the chief officials of the Keighley Corporation, on his leaving the town. The presentation was made by Mr. H. Webber, borough electrical engineer.

Obituary.

Dr. T. Willey.—We learn with regret of the death of Dr. Thomas Willey, late chairman of the London Electric Wire Company and Smiths, Ltd., which took place on October 1st, at the age of 84. Before taking up medicine in 1885, Dr. Willey was associated with the Telegraph Construction and Maintenance Co. as an engineer, and whilst acting in that capacity he founded a small factory in 1879 for making cotton-covered wire, under the name of Winslow & Co., which afterwards became the London Electric Wire Company. Dr. Willey was actively engaged in this company in partnership with his brother, Mr. John Willey, and from 1907 acted as chairman until the time of the amalgamation, in 1909, of the London Electric Wire Co., with Frederick Smith and Co., of Salford. He then became chairman of the new company, the London Electric Wire Company and Smiths, Ltd., and held that position until his retirement in 1918.

Mr. A. Turner.—The death occurred on October 6th of Mr. Alfred Turner, manager of the Hazel Grove and Bramhall Urban Council's electricity undertaking. He was 53 years of age and had been granted six months' leave of absence owing to ill-health. He commenced with the Council as clerk of the works when the electricity scheme was inaugurated in 1923, and was appointed manager of the undertaking in the following year. Previously he was engaged on the electricity schemes at Cheadle and Stockport.

Mr. P. C. Simpson.—We regret to report the death, which occurred on September 30th, of Mr. Percy Cunliffe Simpson, deputy borough electrical engineer of Kingston-on-Thames. Mr. Simpson entered the Corporation electricity works as a pupil in 1898. He was 60 years of age.

M. Eugene Schwarberg.—The death recently occurred in Paris, at the age of 66 years, of M. Eugene Schwarberg, the general director of the Compagnie Electro-Mêcanique and the vice-president of the French Union des Syndicats de l'Electricité.

Dr. D. Adamson.—We learn with regret of the death of Dr. Daniel Adamson, D.Sc., M.Inst.C.E., M.I.E.E., of Joseph Adamson & Co., Hyde, Cheshire, which occurred on October 11th. Dr. Adamson, who was a past-president of the Institution of Mechanical Engineers, was 61 years of age.

Capt. C. O. Dahlbeck.—The death occurred at Gothenburg, Sweden, on October 11th, of Capt. C. O. Dahlbeck, managing director of the Skefko Ball Bearing Co., Ltd.

Wills.—The late **Mr. William Owen**, who was managing director of the Wedmore Electric Light Co. until it was taken over recently by the North Somerset Electric Supply Co., Ltd., left £10,865 gross (£7,895 net personalty).

Mr. John Macgregor, the late chairman and managing director of Johnson & Phillips, Ltd., left estate valued at £30,744 gross and £22,236 net.

The late **Mr. Cuthbert W. Barnes**, Assoc.I.E.E., M.I.Mar.E., left £9,857 (net personalty £8,740).

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Brightway Electrical Co., Ltd.—Private company. Registered October 6th. Capital, £200 in £1 shares. Objects: To carry on the business of importers, exporters and manufacturers of and dealers in electrical fittings and accessories, &c. The permanent directors are: I. Stoller, 84, Farleigh Road, Stoke Newington, N.16, salesman; W. Posner, 14, Sandringham Court, Maida Vale, W.9, merchant. Secretary: H. A Whiting, 69, Leadenhall Street, E.C.

Ranton & Co., Ltd.—Private company. Registered October 4th. Capital, £10,000 in 4,000 six per cent. cumulative preference and 5,800 ordinary shares of £1 each and 4,000 management shares of 1s. each. Objects: To acquire the business of bakelite moulders carried on by P. R. Shackel and F. T. Hinsley at 45, Horseferry Road, S.W., as "Ranton & Co." The directors are: P. R. Shackel, "Hillcrest," 9, Akehurst Street, Roehampton, S.W.15; F. T. Hinsley, "Avonmore," Umbria Street, S.W.15; P. M. Brooke-Hitching, 11, Stanhope Street, W.2. Registered office: 45, Horseferry Road, Westminster, S.W.

Ceramic (Improved Processes) Engineering Co., Ltd.—Private company. Registered October 4th. Capital, £500 in £1 shares. Objects: To acquire the business of mechanical and electrical engineers now carried on by W. Podmore and O. G. Collier as "Ceramic (Improved Processes) Engineering Co." at Shelton, Stoke-on-Trent, and to carry on the business of ironmasters, electrical engineers, manufacturers and repairers of and dealers in dynamos, motors, &c., manufacturers of and dealers in bricks, pottery, &c. The directors are: W. Podmore, Consall Hall, Stoke-on-Trent, ceramic manufacturer and engineer; O. G. Collier, Lyndhurst, Baddeley Green, Stoke-on-Trent, electrical engineer. Secretary: G. S. Cresby. Registered office: Cipec Works, Caledonia Road, Shelton, Stoke-on-Trent.

Ferguson Battery Co., Ltd.—Private company. Registered October 4th. Capital, £3,000 in 5s. shares. Objects: To adopt an agreement with Professor J. W. Hinchley, J. R. Bayes and J. Wilson, and to develop and turn to account the business of renovators and manufacturers of carbons and batteries mentioned therein. The first directors are: J. W. Hinchley, 55, Redcliffe Road, S.W.12 (director of Vitalite Co., Ltd.); J. R. Bayes, 6, Beech Road, Reading, engineer; J. Wilson, 49, Marlborough Road, E.18, engineer. Secretary: H. C. Williams, 44, Rylett Road, W.12. Registered office: 54, Old Broad Street, E.C.2.

Wego Condenser Co., Ltd.—Private company. Registered October 4th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in wireless, telegraphic and telephonic apparatus, valves, instruments and accessories, &c. The directors are: A. W. McNeven, 25, Mayfield Road, Dalston; S. Fifer, 165, Albion Road, Stoke Newington. Secretary: F. C. Parsons. Registered office: 8, Cross Street, Finsbury Pavement, E.C.2.

Farnham Royal Accumulator Co., Ltd.—Private company. Registered October 9th. Capital, £100 in 2s. shares. Objects: To carry on the business of manufacturers of, and dealers in, accumulators, &c. The first directors are: E. Holbrook, 24-25, Western Mail Chambers, Cardiff, accountant; G. Judd, Earl Road, Bermondsey, S.E. Secretary (*pro. tem.*): E. Holbrook. Registered office: 231-232, Berwick Avenue, Farnham Royal, Slough.

Official Returns of Electrical Companies.

Charles Mickleburgh, Ltd.—Capital, £100 in £1 shares. Return dated April 16th, 1930. All shares taken up. £100 considered as paid. Mortgages and charges, £1,000.

Astra Dynamo Co., Ltd. (old company).—H. C. Faulkner, Landor Road Works, Shepherds Bush, W.12, ceased to act as receiver and manager on September 30th, 1930.

Nivex Gauge, Ltd.—J. W. Shepherd, 78, King Street, Manchester, was appointed receiver on October 1st, 1930, under powers contained in debenture dated April 23rd, 1930.

Filtrators, Ltd.—S. H. Mearns, 4B, Fredericks Place, Old Jewry, E.C., was appointed receiver on September 27th, 1930, under powers contained in debentures dated January 1st, 1930.

Shoreham & District Electric Lighting & Power Co., Ltd.—Issue on September 29th, 1930, of £600 and on October 3rd of £300 six per cent. ten year notes, parts of a series already registered.

Wallingford & District Electric Supply Co., Ltd.—Capital, £13,000 in £1 shares. Return dated June 11th, 1930. All shares taken up. £13,000 paid. Mortgages and charges, £4,442.

C. T. Briscoe & Son, Ltd.—Capital, £5,000 in £1 shares. Return dated June 16th, 1930. 2,750 shares taken up. £860 paid. £1,890 considered as paid. Mortgages and charges, £1,184.

A. Melville Sidley, Ltd.—Capital, £1,000 in £1 shares. Return dated May 14th, 1930. 676 shares taken up. £127 paid. £549 considered as paid. Mortgages and charges, nil.

Acme Electric Lamp Co., Ltd.—Capital, £1,000 in £1 shares. Return dated June 14th, 1930. All shares taken up. £2 paid. £998 considered as paid. Mortgages and charges, nil.

Rangoon Electric Tramway & Supply Co., Ltd.—Capital, £600,000 in 250,000 preference and 550,000 ordinary shares of £1. Return dated May 13th, 1930. 250,000 preference and 400,000 ordinary shares taken up. £585,000 paid on 250,000 preference and 335,000 ordinary shares. £65,000 considered as paid on 65,000 ordinary shares. Mortgages and charges at date of return, £346,771.

Shardlow Electric Wires, Ltd.—First mortgage debenture dated October 1st, 1930, to secure £1,304, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. A. Smith, Melton Road, West Bridgford.

Allite, Ltd.—J. W. Rochester, 5, 6 and 7, Dysart Street, E.C.2, ceased to act as receiver and/or manager on October 1st, 1930.

City Notes.

Ferranti, Ltd.

The ordinary dividend is 6 per cent., less tax, against 12 per cent., tax free, for 1928-29, but it is payable on a larger capital.

Parsons Marine Steam Turbine Co., Ltd.

The report for the year ended June 30th last shows a profit of £20,747, as compared with £22,344 in the preceding year, to which is added £32,222 brought in, making £52,747 available. It is proposed again to pay a dividend of 10 per cent., tax free, on the ordinary shares, and to carry forward £31,619.

Yorkshire Electric Power Co.

At an extraordinary meeting on October 7th, resolutions were passed authorising the directors to create and issue £2,000,000 of 5 per cent. redeemable debenture stock, and providing for the redemption of the existing 5½ per cent. debenture stock.

Barcelona Traction, Light & Power Co., Ltd.

An interim dividend has been declared of 50 cents per share on the ordinary shares of no par value.

Marconi International Marine Communication Co., Ltd.

The directors have declared an interim dividend of 5 per cent., less tax (same).

Urban Electric Supply Co., Ltd.

An interim dividend at the rate of 6 per cent. per annum, less tax (same), has been declared.

River Plate Electricity Co., Ltd.

An interim dividend is announced of 3 per cent., less tax (same on smaller capital).

Stocks and Shares.

Tuesday Evening.

Stock Exchange markets have been disturbed by violent falls in the stocks and shares of American companies, railroad and utility shares being prominent in a slump which touched the fringe of demoralisation. Compared with prices prevailing not much more than twelve months ago, some of these stocks and shares have lost anything from 100 to 200 points, a statement which conveys little until it becomes emphasised by experiences that fall within personal ken. Speculation in America is very much more widely spread than it is on this side, and the effects, therefore, of any sharp shakeout can easily be devastating. The effect, moreover, of a fall is cumulative. The speculator who has bought shares on margin, and who loses that margin by reason of a fall in the price of his stock, is asked to put up more and more on each successive drop. There comes a time when he may have exhausted all his resources, and is compelled to throw the shares on a market in which too many others, like himself, are struggling to escape. The American market imbroglio adds one more factor making for weakness to the other elements with which Stock Exchange markets on this side of the Atlantic are faced. Revolution in Brazil, severe shrinkage in the Argentine exchange, and financial troubles in Paris, are other depressing conditions now painfully apparent.

Investment Seeking Safety.

The revolution in Brazil, much more serious than the recent *coup d'etat* in the Argentine Republic, is a serious contribution to the anxieties of the moment. A rise in the Berlin Bank Rate on Thursday last week came as an unpleasant shock to European Bourses. All these matters serve to compel capital to seek, more and more, the safety of the purely gilt-edged securities. Prices of Government stocks remain very steady, with no more than occasional reaction on profit-taking sales by people who, recognising the trend of world finance, have been speculating in such stocks instead of buying industrials. The British Government placed, a few days ago, four per cent. Treasury bonds, 1934-1936, at the average high price of £100 11s. 6d. per cent., which is in itself an indication of the flight of money into "safety first" stocks.

London's Transport Unification.

The Government has added little to the information published as to the official intention with regard to the unification of London traffic. Plenty of play is left for the exercise of the imagination, and it seems to be pretty generally agreed that under the new arrangement, whatever it may be, no object is likely to be served by the acquisition of the Metropolitan Railway by the Underground Electric Railways of London. Even on this point, however, considerable uncertainty exists. Metropolitans have slipped back 2 points to 71, which is 4½ points lower than the price touched a fortnight ago. Districts, on the other hand, are better at 75. Underground Electric ordinary shares at 23s. are 1s. down, a decline which has no significance save as a reflection of the unsettled conditions that prevail round Stock Exchange markets. In the shares of London tramways and transport companies, there is very little going on, but London and Suburban preference hold their rise at 11s.

Metropolitan Possibilities.

Although it is considered that there will be no special object, in view of the Government's proposals, in the purchase of the Metropolitan Railway by the Underground Electric, an ingenious theory is put forward in substitution of the hope that the former deal might have been consummated. As mentioned here previously, the Underground Electric Railways of London requires only that part of the Metropolitan system that lies within what may be called the "circle" area; the Metropolitan's extension is of no great value to the Underground. The suggestion now is that the two parts of the Metropolitan Railway's system might be divided, one being absorbed by the "circle," and controlled by the Underground Railway, the other part going to the Great Western Railway, with which the Metropolitan has had intimate traffic associations for many years.

Tube Debentures.

So keen was the rush for the 5 per cent. debenture stocks offered, at 99½, by the London Electric and the Central London Railways, that the applicants received no more than 4 per cent. Small subscribers were cut out. Dealings started on Monday in this week. A ready-made demand existed in advance, and the prices rapidly advanced from 1½ premium to 35s. premium. At the latter figure, a considerable amount of stag-stock came to market, and the prices consequently halted. The quotations are moving simultaneously, for the security is much the same in each case, the partial Government guarantee applying to them both, and on similar terms. The Central London amount is, however, the smaller of the two, and it will rapidly get into permanent investment hands. In the London Electric issue, where a freer market prevails, there will probably be mild speculative interest for a time.

Home Electricity Supply.

No changes have occurred in the prices of the shares in the London Electricity Supply group. The market is one which

reflects the conditions current in respect of the purely gilt-edged issues, and, for this reason, holders of the shares are in no hurry to part from their interests. In the provincial lists, Yorkshire Electrics have risen 9d. to 32s. Newcastle ordinary are lower by the same amount at 23s. Midland Counties at 26s. are ex dividend. The allotments of the new ordinary shares have been distributed to proprietors, the ordinary capital being increased by the issue of 450,000 new shares, offered at 24s. each in the proportion of one new for each five held. The new shares will rank for dividend as from January 1st next, and interest at 6 per cent. is to be paid on instalments up to the end of this year. It will be noticed that there is a small turn offered here to proprietors. The price of the new shares is, accordingly, 9d. to 1s. premium. The Urban Electric Company has declared an interim dividend of 6 per cent. less tax, payable on November 1st, and the price of the shares remains unchanged at 28s. 9d. The dividend is the same as that of a year ago.

Richmond (Surrey) ordinary shares are a shade lower at 40s. British Light & Power shares remain at 14s. 6d. Isle of Thanet preference have risen 6d. to 23s. 6d.: the ordinary keep at 26s. 6d. Scottish Electric Power new shares have shaded off to their "par" price of issue. The Yorkshire Electric debenture stock should be accepted by those who have the right to an allotment, for a premium is almost sure to materialise when dealings start in the scrip.

Electrical Debenture Stocks and Bonds.

Further rises have occurred in the debenture stocks recently issued by commercial undertakings. Newcastle-on-Tyne Electric 5 per cent. debenture is 10s. higher at 5¾ premium. Edmundsons' debenture is 15s. up at 4 premium. G.E.C. new debenture is 5s. harder at 1¼ premium. Amongst the few bonds with which this market deals, Tokyo Electric 6 per cents. have gone back to 94¼, in sympathy with the fall in American securities. There is an issue of these bonds in New York as well as in London, and, as the former can be bought substantially cheaper than the latter, sales of the London issue of Tokyo Sixes have been taking place, in order that the money may be re-employed in the purchase of similar bonds in New York. The issues are not interchangeable, so far as dealings are concerned. Therefore, when a sale is made, this must be carried out in New York, where prices are frequently lower than the quotations of the same bonds here.

Fresh Falls in Cables.

At one time this week it became again possible to buy £100 of each of the Cables & Wireless stocks, preference, "A" ordinary, and "B" ordinary, for £100 money. The preference was forced down, by heavy liquidation, to 66. The "A" fell to 21 and the "B" to 10. From these levels there was a trifling recovery. The preference stock at 67½ shows a drop of 6 points, and the "A," at 22½, is 3 down. Selling from New York is hinted as a reason for the latest slump, but the real explanation probably lies nearer home. The preference stock at the present price yields £8 3s. per cent. on the money, a return that emphasises the anxiety felt in regard to the maintenance of dividend payments. But to the speculative investor who can afford to lock up money, the preference offers temptation. Postal Telegraph & Cables 25-year collateral 5 per cent. bonds have fallen 10 points to 87. American Telephone & Telegraph shares have gone back to 202 and Internationals to 28¼, falls of 5¼ and 4 points, respectively.

An interim dividend of 5 per cent. less tax, the same rate as that of a year ago, has been declared on Marconi Marine shares, and the price of 36s. 3d. is ex this shilling. With the dividend declaration, the board issued a statement endorsing its previous circular of four months since, in which the steady progress of the company was indicated. Anticipation looks for the final dividend to be 10 per cent., making, as in 1929-30, 15 per cent. for the whole year.

Heavy Falls in Dollar Stocks.

Brazilian Traction ordinary have dropped 8 to 23, and the preferred 10 to 90, on the serious character of the revolution in the Republic. The company has declared its quarterly dividend in scrip instead of cash. Sao Paulo Tramways 5 per cent. debenture is 4 lower at 80½. Rio Tramway firsts and seconds are down to 101 and 84½, respectively. Southern Brazil Electric 6½ per cent. debenture has gone back to 72½.

Consolidated Gas & Electric of Baltimore at 108¼ is 8 points down. Shawinigan Water fell to 56, at which the loss on the week is 8½. Pennsylvania Water & Power shed the same amount in one day, to 67, but rallied to 69. Hydro-Electrics went back to 28½. British Columbia Power "B" to 35¼, and the "A" to 12. The melancholy tale could be extended, unhappily, but these movements are quite sufficient to point the general extent of the slump.

Manufacturing and Equipment Shares.

General Electric Co., Ltd., ordinary, Associated Electrical Industries, British Insulated, Henleys, and Siemens are amongst the shares whose prices have gone back. The first two named are influenced directly by the American flatness. The others have suffered in sympathy with general conditions here. It will be noticed that to the final section of our price-lists, Ferranti 7 per cent. preference are added this week. Amongst engineering and allied shares, Babcock & Wilcox show a slight advance, to 53s. 9d. Vickers are dull at 7s. 1½d.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price Oct. 14 1930.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	58/9	—	5 2 0
Brompton Ordinary	1	8½	8½	26/6	—	5 5 8
Charing Cross Ordinary	1	8½	8½	28/-	—	5 0 0
do. do. 4½% Pref. ...	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8¼	8¼	27/-	—	5 3 8
City of London	1	10	10	33/9	—	4 8 1
do. do. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	37/6	—	4 5 4
County of London	1	7	10	46/3	—	4 6 6
do. do. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	47/-	—	4 13 7
Kensington Ordinary	1	8	8	27/-	—	5 3 8
Lancs. Light and Power	1	7½	7	24/-	—	5 16 8
London Electric	1	8½	9	30/-	—	4 13 4
Metropolitan	1	9	10	2⅛	—⅛	4 18 6
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	7	26/-xd	—	5 7 8
Mid. Elec. Power	1	15	8	30/9	—	5 4 1
Newcastle-on-Tyne Ordinary ...	1	6	6	23/-	—9d.	5 4 4
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 4
North Met. Elec. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	28/6	—	5 12 4
South London	1	8½	8½	27/-	—	5 8 8
Urban Ordinary	1	7	7	28/9	—	4 17 5
Westminster Ordinary	1	8½	8½	27/6	—	5 1 10
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	32/-	+9d.	5 0 0

Home Rails.

Central London Ord. Assented ...	Stock	4	4	78	—	5 2 7
Metropolitan	,	3½	4	71	—2	5 12 8
do. District	,,	4	5	75	+2½	6 13 4
Underground Electric	£1	7	8	28/-	—1/-	6 19 2
do. do. Income ...	Bonds	6	6	104	—	5 15 5

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102	+½	5 17 8
do. Def.		1½	1½	25	—	6 0 0
Automatic Telephone	1	10	12½	33/9	—	7 8 4
Cables & Wireless 5½ Pref.... ...	Stock	—	5½	67½	—6	8 3 0
do. A 7½ Ord.	,,	—	—	22½	—3	... ...
do. B Ord.	,,	—	—	11	—1	... ...
Globe Tel. and T. Ord.	10	10	10	14½	—	*8 18 6
do. do. Pref.	10	6	6	10¾	—	5 11 7
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	36/3xd	—	8 11 6
Oriental Telephone Ord.	1	12	12	2⅞	—	*4 18 4

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2⅛	—⅛	11 18 0
do. do. 2nd Pref. ...	5	6	6	2	—⅛	15 0 0
do. do. 5% Deb. ...	Stock	5	5	58	—3	8 12 4
British Electric Traction Def. Ord.	,,	5	5	1375	—	... ...
do. do. Pref. Ord.	,,	8	8	123½	—	6 6 6
Brazil Traction	100	7	8	23	-8	7 16 10
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	92½	+1	5 8 1
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/-	—	... ...
London United Tram Deb. ...	Stock	4	4	52½	—	7 12 4
Mexico Trams, 5% Bonds	—	5	5	57	—	8 15 6
Mexican Light Common	100	Nil	Nil	62½	—7	... ...
do. 7% Pref.	100	7	7	78½	+2	8 18 4
do. 1st Bonds	—	5	5	80	—	6 5 0
Victoria Falls Ord.	1	15	15	3	—	5 0 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	6	20/6	—1/6	5 17 1
Babcock & Wilcox	1	13	15	53/9	+6d.	*5 11 6
British Aluminium Ord.	1	10	10	38/9	—⅛	5 3 0
British Insulated Ord.	1	15	15	3 7/16	—1/16	4 7 3
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3⅞	—	4 10 8
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	20/-	—	7 10 0
do. 8% Pref.	1	8	8	26/3	+6d.	6 2 0
Edison-Swan 1st. Pref.	1	7½	7½	23/9	—⅛	6 6 4
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	5½	5	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4¼	—	5 17 8
English Electric	1	Nil	Nil	11/3	—9d.	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Ferranti Pref.	1	7	7	20 3	—	6 18 8
Gen. Elec. Pref.	1	6½	6½	24/3	—	5 7 2
do. Ord.	1	10	14	43/3	—⅞	6 9 4
Henley	1	25	30	5⅞	—1/16	5 4 1
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	7/6	—	... ...
Johnson & Phillips	1	10	10	1⅝	—	5 6 8
Siemens Ord.	1	7½	7½	1	—1/16	7 10 0
Telegraph Construction	12	10	10	19	—	*6 6 7

* Dividends paid free of Income Tax.

Forthcoming Events.

Faraday House Old Students' Association.—October 17th. Savoy Hotel, Strand, W.C. 6.30 for 7 p.m. Annual dinner.

Junior Institution of Engineers.—October 17th. 39, Victoria Street, S.W. 7.30 p.m. "The London Automatic Telephone System." Mr. T. H. Flowers.

Institution of Mechanical Engineers.—October 17th. Institution, Storey's Gate, St. James's Park, S.W. 6 p.m. Presidential address. Mr. L. St. L. Pendred.

Association of Supervising Electrical Engineers.—October 21st. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. Presidential address. Mr. S. B. Donkin.

Institute of Fuel.—October 22nd and 23rd. Incorporated Accountants' Hall, London. Annual conference.
October 22nd. Connaught Rooms, Great Queen Street, W.C. 6.45 p.m. Annual dinner and dance.

Institution of Electrical Engineers.—October 23rd. Institution, Savoy Place, Victoria Embankment, W.C. 6 p.m. Inaugural address. Mr. C. C. Paterson.

(Mersey and North Wales (Liverpool) Centre.)—October 20th. University, Brownlow Street, Liverpool. 7 p.m. Chairman's address. "The Development of the Telephone System." Mr. A. J. Pratt.

Birmingham Electric Club.—October 24th. Grand Hotel, Colmore Row, Birmingham. 7 p.m. "Pros and Cons of Factory Electrical Equipment." Mr. R. H. Rawll.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

7,928. "Method of increasing the electrical conductivity of atmospheres surrounding electric arcs used for heating or welding purposes." I. G. Farbenindustrie Akt Ges. March 14th, 1928. (307,834.)

8,116. "Supply of current to wireless sets from electric power mains." Loewe Radio Ges. January 23rd, 1929. (335,225.)

8,365. "High ohmic resistances." Siemens & Halske Akt. Ges. March 21st, 1928. (308,308.)

8,619. "Apparatus for electromagnetic separation." S. W. Sambouroff. March 16th, 1929. (335,227.)

8,939 "Electric signalling systems." I. J. Lichter. March 19th, 1929. (335,198.)

9,053. "Combined wireless receiving sets and loud-speakers." G. G. Yrarrazaval de Andia. March 20th, 1929. (335,229.)

9,288. "Manufacture and production of electrolytic cells." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). March 22nd, 1929. (335,151.)

12,437. "Apparatus for the electrical reproduction of sound." British Thomson-Houston Co., Ltd. April 21st, 1928. (310,284.)

15,097. "Electric discharge tubes for producing flush lights." D. P. A. A. Kayser. May 26th, 1928. (312,356.)

15,191. "Electric discharge devices." British Thomson-Houston Co., Ltd. May 19th, 1928. (312,073.)

17,460. "Electric cut-outs, connectors, and the like." G. O. Donovan, W. Donovan, and E. T. G. Donovan. June 6th, 1929. (335,158.)

18,064. "Electric heating devices, such as hot-plates, boiling-plates, and the like." C. B. Backer. June 12th, 1929. (335,160.)

18,160. "Electrodeposition of chromium." E. V. Hayes-Gratze. June 13th, 1929. (Cognate application, 22,753/29.) (335,161.)

18,251. "Recording of sound on film and the reproduction of recorded sounds." Telefunken Ges. für Drahtlose Telegraphie June 13th, 1928. (313,536.)

18,400. "Inductances and capacities for use with electrical resonant circuit arrangements." H. A. Ewen. June 14th, 1929. (335,164.)

18,644. "Electric radiators." G. Halliday. June 17th, 1929. (335,205.)

18,698. "Electric signalling and control systems." S. Lipman. June 18th, 1929. (335,240.)

18,720. "Electric insulating material." Telefunken Ges. für Drahtlose Telegraphie. July 12th, 1928. (315,354.)

18,816. "Carrier-wave signalling systems." Standard Telephones and Cables, Ltd. June 26th, 1928. (314,382.)

18,817. "Means for reducing interference in signalling circuits." Standard Telephones and Cables, Ltd. June 20th, 1928. (313,964.)

18,860. "Electric signalling systems." Associated Telephone and Telegraph Co. June 28th, 1928. (314,494.)

18,902. "Cleats for supporting electric cables." A. E. Hughes and Liverpool Electric Cable Co., Ltd. June 19th, 1929. (335,221.)

18,938. "Protective systems for electrical circuits." C. M. Longfield. June 20th, 1929. (335,244.)

19,033. "Loud-speakers, telephones, microphones, and the like." H. Vogt. October 4th, 1928. (335,248.)

19,078. "Electric current collectors for use with overhead conductors." R. Brooks and Associated Electrical Industries, Ltd. June 21st, 1929. (335,251.)

19,144. "Loud-speakers." G. A. Vandervell and O. & S. Oilless Bearing Co., Ltd. June 21st, 1929. (335,257.)

19,152. "Television receiving apparatus using electric glow discharge lamps." D. Von Mihaly. June 21st, 1929. (335,258.)

19,212. "Radio-telephonic systems." R. Bruni. June 23rd, 1928. (314,092.)

19,227. "Light-sensitive discharge apparatus." British Thomson-Houston Co., Ltd. June 22nd, 1928. (314,096.)

19,231. "Tensioning means for diaphragms for loud-speakers and the like." H. Vogt. April 5th, 1929. (335,261.)

19,253. "Current-collector shoes for electric railway vehicles." English Electric Co., Ltd., and F. Morris. June 22nd, 1929. (335,263.)

19,254. "Collector-shoe suspension for electric railway vehicles." English Electric Co., Ltd., and F. Morris. June 22nd, 1929. (335,264.)

19,255. "Brake rigging for railway and like vehicles." English Electric Co., Ltd., and J. Baldie. June 22nd, 1929. (335,265.)

19,467. "Electrical discharge tubes with rare-gas fillings." A. Lederer. July 3rd, 1928. (Addition to 306,831.) (314,864.)

19,515. "Methods of, and apparatus for, mounting filaments for electric incandescent lamps and similar articles." British Thomson-Houston Co., Ltd. June 25th, 1928. (314,353.)

19,518. "Receivers for telegraphic and like signals." Electrical Research Products, Inc. September 15th, 1928. (Addition to 312,338.) (318,989.)

19,539. "Electric equipments for motor vehicles." Soc. des Magnetos R.B. October 20th, 1928. (335,276.)

19,545. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. E. Beale, and H. S. Deyes. June 25th, 1929. (335,278.)

19,561. "Lighting systems for vehicles." W. J. Tatnell. June 25th, 1929. (335,279.)

20,241. "Hinge supports for devices for recording sound waves and the fluctuations of electric currents." P. G. A. H. Voigt. July 2nd, 1929. (Cognate application, 20,242/29.) (335,290.)

20,382. "Means for starting synchronous motors." Telehor Akt. Ges. March 7th, 1929. (335,291.)

20,487. "Insulators for electrical apparatus." E. A. Hailwood. July 4th, 1929. (335,293.)

20,762. "Electrical circuits for the amplification of electrical impulses." J. I. Smith and A. E. Clarke. July 5th, 1929. (335,295.)

20,853. "Apparatus adapted to be automatically actuated by predetermined received signals." Telefunken Ges. für Drahtlose Telegraphie. July 19th, 1928. (315,838.)

21,073. "High-speed printing telegraphs." Soc. Française Radio-Electrique. July 28th, 1928. (316,298.)

21,801. "Electric junction boxes or other conduit elements for electric conductors." Walsall Conduits, Ltd., A. E. Read, and C. G. Maisey. July 16th, 1929. (335,306.)

22,084. "Coated cathodes for electron discharge devices." Westinghouse Lamp Co. July 18th, 1928. (315,800.)

22,507. "Coated cathodes for electron discharge devices." Westinghouse Lamp Co. July 20th, 1928. (316,104.)

23,303. "Electric fuses." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 14th, 1928. (318,996.)

23,305. "Telephone instruments." J. E. Pollak (Associated Telephone and Telegraph Co.). July 29th, 1929. (Cognate application, 39,749/29.) (335,319.)

23,576. "Polarised electric relays." Siemens & Halske Akt. Ges. August 2nd, 1928. (316,675.)

23,739. "Electric water heaters." L. P. Haussauer. August 2nd, 1929. (335,323.)

23,762. "Apparatus, specially wireless apparatus, having a single control for several rotating parts." F. Savoye. August 2nd, 1929. (Addition to 310,050.) (335,324.)

24,118. "Telephonic or like loud-speakers." P. A. Craven. August 7th, 1929. (335,329.)

24,441. "Electrical condensers." A. A. Thornton (Grinsby Grunow Co.). August 9th, 1929. (335,330.)

24,786. "Electric cut-outs for weaving looms." A. E. Williams. August 14th, 1929. (335,334.)

25,345. "Electric heaters for radiation and all other purposes." T. E. Beaumont and J. N. Waring. April 30th, 1930. (335,337.)

25,567. "Electrical sound-reproducing and recording instruments and apparatus." H. Branton, H. G. Bawtree Williams, E. A. Bitton, and H. A. Storry, Ltd. August 22nd, 1929. (335,340.)

25,623. "Multi-stage amplifiers and coupling devices for use therein." Siemens & Halske Akt. Ges. August 22nd, 1928. (317,800.)

25,629. "Wireless receivers." Gramophone Co., Ltd., and A. Whitaker. August 22nd, 1929. (335,342.)

26,145. "Power-factor measuring or indicating instruments for use with alternating electric currents." Chamberlain & Hookham, Ltd., and S. James. August 28th, 1929. (Addition to 193,243.) (335,347.)

26,188. "Coil ignition systems for motor cycles." British Thomson-Houston Co., Ltd., and L. Griffiths. August 28th, 1929. (335,349.)

26,778. "Electrical heaters." J. H. Crossley and Associated Electrical Industries, Ltd. September 3rd, 1929. (335,354.)

26,850. "Photo-electric cells." British Thomson-Houston Co., Ltd. September 27th, 1928. (Addition to 303,476.) (319,734.)

27,168. "Pupin coil boxes." Felten & Guillaume Carlswerk Akt. Ges. October 6th, 1928. (335,356.)

27,260. "Photo-electric cells." Arcturus Radio Tube Co. September 8th, 1928. (318,641.)

27,846. "Electric motors." Siemens-Schuckertwerke Akt. Ges. December 27th, 1928. (335,360.)

28,319. "Arrangements for mounting filaments in electron-discharge devices." British Thomson-Houston Co., Ltd. September 18th, 1928. (319,245.)

28,470. "Electrical switch installations with removable enclosed switch trucks for use in duplicate bus-bar systems." Siemens-Schuckertwerke Akt. Ges. February 19th, 1929. (335,365.)

28,745. "Microphones." A. Graham & Co., Ltd., and W. Stott. September 23rd, 1929. (335,367.)

28,887. "Electrical heating elements for curling tongs." R. Bosch Akt. Ges. October 6th, 1928. (335,370.)

29,628. "Multiplex communication systems." Marconi's Wireless Telegraph Co., Ltd. September 29th, 1928. (320,024.)

29,755. "Electrical switches." S. Ruppel. October 2nd, 1928. (335,380.)

29,890. "Electric lampholders." F. W. Yates, A. Kipling, and J. K. W. Manufacturing Co., Ltd. October 2nd, 1929. (335,384.)

1930.

600. "Thermionic amplifiers." E. Asch. January 8th, 1929. (Addition to 300,511.) (335,484.)

2,872. "Electro-mechanical devices used in the control of lifts." J. E. Keith. January 28th, 1930. (335,494.)

3,931. "Dynamo-electric machinery." Associated Electrical Industries, Ltd. February 6th, 1929. (335,496.)

5,443. "Method of and means for heating electric high-tension insulators." Lodge-Cottrell, Ltd. (Metallges Akt. Ges.). February 18th, 1930. (335,503.)

6,736. "Thermionic oscillation generators." Marconi's Wireless Telegraph Co., Ltd. March 30th, 1929. (335,507.)

9,502. "Indicating control means for radio receivers and the like." British Thomson-Houston Co., Ltd. March 29th, 1929. (335,509.)

19,025. "X-ray tubes." H. Seabrook (Muller Akt. Ges. C. H. F.). August 27th, 1929. (Divided application on 26,075/29.) (335,510.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 8th:—

Pertrix (lettering and design). No. 505,234. Class 8. Primary batteries (electrical) and parts thereof.—Pertrix, Ltd., Britannia House, 233, Shaftesbury Avenue, W.C.2.

Enfelcam. No. 515,391. Class 8. Electric cables.—Enfield Cable Co., Ltd., 296-302, High Holborn, W.C.1.

Orpheus (design only). No. 515,538. Class 8. Radio-telephonic receiving sets and sound reproducing instruments and parts thereof.—J. Walsh & Sons, Ltd., 72-76, Northgate, Blackburn.

Cressida. No. 515,585. Class 8. Radio receiving sets in combination with gramophones, radio receiving sets, sound amplifiers and parts thereof.—Electrical Reproducers, Ltd., 112, West Regent Street, Glasgow.

Defiance. No. 502,914. Class 13. Sparking plugs and parts thereof.—Defiance Spark Plugs, Inc., Toledo, Ohio, U.S.A. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Tedi. No. 515,803. All goods in Class 13.—Siemens-Schuckertwerke Gesellschaft, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Annealogic. No. 515,361. Class 50. Insulating substances (electrical) composed of bitumen and india-rubber, or bitumen and gutta-percha, the bitumen predominating.—Telegraph Construction and Maintenance Co., Ltd., 38, Old Bread Street, E.C.2.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALDERSHOT.—Motor-omnibus station for the Aldershot and District Traction Co., Ltd.

ALFRETON.—Re-erection of works, Pye Bridge, for the Midland Acid Co., Ltd.; F. Bettison, manager, Somercotes (£10,000).

ALTRINCHAM.—Theatre, Barrington Road; secretary, Altrincham Garrick Society.

ARBROATH.—Alterations to Olympia Theatre for North of Scotland Entertainments, Ltd.; the manager.

ASHTON-UNDER-LYNE.—Fire station and offices; W. H. George & Son, architects, 7, Warrington Street.

BATH.—Houses (360) for the T.C.; Copp Bros., builders, Barry. Extension, Combe Park Hospital (£20,000); Axford & Smith, builders, Widcombe. Block of flats (£50,981) for the T.C.; W. J. B. Hall, Ltd., builders, Gloucester.

BILSTON.—Houses (70) for the U.D.C.; A. M. Griffiths and Son, Ltd., builders, Wolverhampton.

BLACKPOOL.—Technical school for the Corporation; J. S. Robinson, borough architect, Town Hall.

BROMLEY.—Extensions, Girls' School, for the Kent E.C.; W. H. Robinson, architect, Springfield, Maidstone.

CHESHAM.—Houses (50) for the U.D.C.; F. T. Moss, surveyor.

CHESHUNT.—Houses (136) for the U.D.C.; J. E. Sharpe, builder.

CHESTERFIELD.—Houses (50) for the R.D.C.; G. Rowley, builder, Chesterfield Road, Brimington. Works extensions, Sheffield Road; Lamp Caps, Ltd.

CROYDON.—Nine shops, Farley Road; W. Akers & Co., Ltd.

CUPAR (Fife).—Housing scheme, with electrical work, for the T.C.; A. D. Hoxton, architect, Commercial Road, Leven (tenders by October 22nd).

DOVER.—Extensions, Poor Law Institution (£32,000), for Kent Public Assistance Committee; clerk, Maidstone.

DUNDEE.—Telephone exchange for H.M. Office of Works; the postmaster, Dundee (tenders by October 28th).

EASTBOURNE.—Extensions, Princess Alice Hospital, Carew Road; P. D. Stoneham & Son, architects.

EAST SUFFOLK.—Schools, Kesgrave, Pakefield, and special subjects centre, Shotley, for the E.C.

EDINBURGH.—Alterations and improvements to the Bank of Scotland, Bank Street; Colin Macandrew, Ltd., building contractors, 11, West End Place. Telephone exchange at Abbeyhill; Commissioners of H.M. Works.

ELLESMERE PORT.—Catholic church (£10,000), with lighting and heating work; Salter Bros., builders.

ESSEX.—Schools, Rochford (£21,821), Rainham (£17,242), Hornchurch (£19,739), and extensions, Dagenham (£37,539), for the county E.C.; director of education, Chelmsford.

GLASGOW.—Reconstruction scheme at Lewis's Royal Polytechnic (£40,000), with electric lighting, lifts, and escalators; J. Leake, manager. Houses (1,364) at Cathcart; secretary, Western Heritable Investment Co., Ltd., 51, Bath Street.

GLOUCESTER.—County offices for the C.C.; E. S. Sinnott, county surveyor.

GRANTHAM.—Houses (52) for T.C. (£18,750); Campion and Benny, Holbeach, contractors.

HARPENDEN.—Development of Hatching Green estate (300 acres); E. C. Jarvis, builder, Vaughan Road.

HINCKLEY.—Houses (100), Middlefield Lane site; surveyor to U.D.C.

HORNCHURCH.—Houses (2,700), Elm Bush and Grey Tower estates; estate owners.

HUDDERSFIELD.—Re-erection of Upper Bankfield Mills, Mold Green, for Samuel Firth & Co.

HULL.—Houses (310), Marfleet Lane; Sutton Dwellings Trust. Houses (750) and school (1,320 places), Endyke estate; city architect.

HUNCOAT (Accrington).—Catholic church and schools, Altham Lane; Rev. Father McAvoy.

IRISH FREE STATE (Loughrae, Co. Galway).—Electrical installation at County Home for the County Board of Health; J. P. Tierney & Co., consulting engineers, 44, Kildare Street, Dublin.

KINCARDINESHIRE.—School at Laurencekirk (£21,500); master of works, Education Committee, Laurencekirk.

LEWES (Sussex).—Houses (40), Ham Lane, for the Southern Railway Co., Ltd.; engineer.

LONDON (East Ham, E.).—Electric lighting installation, Monega and Sandringham Road schools, for the borough E.C.; clerk.

(Ilford, E.).—Houses (42), Offley Drive; J. Aldridge.

(Walthamstow, E.).—Extensions, Chingford Isolation Hospital; borough engineer.

(Brixton, S.W.).—Reconstruction, Empress Music-hall Andrew Mather, architect.

(Norbury, S.W.).—Thirty-seven garages, Pollards Hill South; S. Salmon.

(Edgware, W.).—Houses (300), Canons Park estate; A. J. Butcher, architect.

(Kensington, W.).—Clearance schemes and erection of flats (94); borough engineer.

LOUGHBOROUGH.—Cinema (2,000 seats), Ashby Road, for Universal Car Co., Ltd., 10, Market Street, Leicester; Albert E. King & Co., architects.

MACCLESFIELD.—Labour exchange for H.M. Office of Works, King Charles Street, London, S.W.

MAIDENHEAD.—Workshops, stores, and garage for the T.C.; borough surveyor.

MARPLE (Ches.).—Extension of the County Nursing Home, Dale Road, Rose Hill; Tom Gaskell & Co., builders, 193, Wilmslow Road, Withington, Manchester.

MIDDLESBROUGH.—Two schools for the borough E.C.; director of education.

NORTHAMPTON.—Houses (177) and shops, Kettering Road estate; borough engineer. Ten blocks of tenements, St. David's estate; borough engineer.

ORSETT.—Extensions, nurses' home, for Essex Public Assistance Committee; J. Stuart, county architect, Chelmsford.

PAIGNTON (Devon).—Catholic church; Melhuish & Berry, builders, Osney Crescent.

PERTH.—New headquarters for Joint County Council of Perth and Kinross (£27,000); the county clerk.

PONTEFRACT.—Municipal offices (£14,600) for the T.C.; borough surveyor.

READING.—Houses (500), Whitley estate; borough engineer.

REDHILL.—Post office, London Road, for H.M. Office of Works, King Charles Street, S.W.

REIGATE.—Health centre (£10,000) for the T.C.; R. Holford & Co., builders. Extensions, municipal buildings (£10,000); Burnand & Pickett, Ltd., builders, Wallington.

ROTHERHAM.—Extensions, Masbro' Independent Chapel; chapel trustees. Elementary school, Herringthorpe (£15,000) and central school, with swimming bath, Clough site; borough engineer.

ST. HELENS.—Houses (38) for the T.C.; borough surveyor.

SCARBOROUGH.—Town hall extensions (£19,000) for the T.C.; borough surveyor.

SOUTHPORT.—Extensions, Fleetwood Road Hospital, for the T.C.; A. E. Jackson, borough engineer.

STANWAY.—Extensions, Poor Law Institution (£175,000); Essex county architect.

STEVENAGE.—Houses (50) for the U.D.C.; R. Gandy, surveyor.

STOURBRIDGE.—Houses (172), High Park estate, for the T.C.; borough surveyor.

TORQUAY.—Swimming baths, Upton (£22,706); R. Wilkins and Son.

UXBRIDGE.—Houses (66), Cowley, for U.D.C.; Building and Public Works Construction Co., contractors, Swindon.

WATFORD.—Houses (34), North Western Avenue; Kempster & Williams.

WEST HARTLEPOOL.—Sea-front development, &c., Seaton Carew (£22,000); borough engineer.

WORTHING.—Presbyterian church; Morter & Dobie, architects, Liverpool.

YIEWSLEY.—Houses (100) on Falling Lane housing site for U.D.C.; W. T. Morgan, surveyor.

YORK.—Extensions, York Diocesan Training College; governors.